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Scientific and Technical Information Division
National Aeronautics and Space Administration

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VOLUME 2 NUMBER 23

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

December 8, 1964

01 GENERAL

Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

N64-31558* National Aeronautics and Space Administration, Washington, D.C.
ORGANIZATIONAL MEASURES FOR THE SUPPORT OF A SPACE PROGRAM
Mar. 1964 137 p refs Transl. into ENGLISH of Organisatoriska Atgarder for Rymdverksamhetens Framjande, the Government's Public Investigations 1961–1963, The Board of Education (Stockholm), 1963
(NASA-TT-F-8801) OTS: $4.00 fs; $0.75 mf

A review was made of the scientific background of space exploration and some technological applications, of the organization, extent, and aim of space exploration in different countries, of international cooperative organizations, and of current and planned space activities in Swedish research and industry. This review and the conclusions drawn from it are presented. Conclusions include the motive for a Swedish space program, suggestions on the organization of Swedish space research, and a cost estimate of a Swedish space program for a 3-year period. D.E.W.

N64-32041* National Aeronautics and Space Administration, Washington, D.C.
NASA TECHNOLOGY TRANSFER TO INDUSTRY AND BUSINESS News Release
James E. Webb [1964] 11 p Presented at the Young Presidents' Organization Eastern Area Conf., White Sulphur Springs, W. Va., 3 Oct. 1964 Available from the Scientific and Technical Information Div.

Efforts of NASA to make technological developments from the space program available to potential industrial and business users are outlined. The major resources that the space effort is developing are recounted. The wealth of information and innovations generated by these projects is systematically organized and evaluated by NASA's Technology Utilization Program and repackaged to meet the needs of nonaerospace industries. The Aerospace Research Applications Center uses a computer to match space technology information with the needs and interests of specific participating companies. The Midwest Research Institute is serving an eight-state area as the focal point for the dissemination and use of knowledge originating from the space program. Similar programs are being set up in other geographic sectors. Examples are given of the techniques and products that have already attracted industrial interest. M.P.G.

N64-32042* National Aeronautics and Space Administration, Washington, D.C.
EXCERPTS FROM REMARKS BY JAMES E. WEBB, GRAND RAPIDS, MICHIGAN, OCTOBER 7, 1964 News Release
James E. Webb [1964] 7 p Available from the Scientific and Technical Information Division

Excerpts from an address by James E. Webb cover the following topics: (1) the impact of the space program on education and the close cooperation between Government, industry, and the university in carrying out the largest research and development program in all history; (2) the convictions upon which the National space program is predicated; (3) the benefits of space exploration in all the other branches of human learning; (4) the factors upon which the Apollo program are based; (5) economic and political considerations that argue against any effort to slow down the National Space Program as an economy measure; and (6) the importance of modern technology in maintaining world stability. M.P.G.

N64-32267 Air Force Office of Scientific Research, Washington, D.C.
UNITED STATES AIR FORCE RESEARCH AND OTHER PROGRAMS OF THE OFFICE OF AEROSPACE RESEARCH FOR FISCAL YEARS 1964–1965
1964 159 p
(AD-601009)

Areas covered include propulsion, materials, electronics, aeromechanics, environmental sciences, mathematics, psychology, biology, and medicine. In each area, a number of projects are listed; given for each is its objective; a brief description of the approach and emphasis; future plans; and various data such as personnel, duration, organization, etc. D.E.W.

N64-32380* National Aeronautics and Space Administration, Washington, D.C.
DEDICATION OF THE HALL OF SCIENCE, WORLD'S FAIR, NEW YORK CITY, NEW YORK, SEPTEMBER 9, 1964 News Release
James E. Webb [1964] 4 p

Comments are given on the significance of the Hall of Science in the understanding of scientific disciplines on the part of the general public. D.E.W.

N64-32591 Technisch Documentatie en Informatie Centrum voorde Krijgsmacht, The Hague (Netherlands)
OPERATIONS RESEARCH IV: TITLE-INDEX
Dec. 1963 52 p refs
(TDCK-36938)

This index contains titles of publications announced in the issues O.R. 42 up to and including O.R. 53 of the abstract bulletin "Operations Research," published in 1963. Author

N64-32634* National Aeronautics and Space Administration, Washington, D.C.
THE NEW AGE OF DISCOVERY News Release
James E. Webb 1 Apr. 1964 22 p , Address presented to the Am. Assembly Student Conf., AF Acad., Colorado Springs, Colo.

The history of exploration is traced from Henry the Navigator to Goddard. The development of jet- and rocket-propulsion systems is briefly described. The NASA space-exploration program is discussed in nontechnical terms, with emphasis on Gemini and Apollo missions. D.E.W.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-31452* United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF NONEQUILIBRIUM FLOW EFFECTS IN HIGH EXPANSION RATIO NOZZLES. COMPUTER PROGRAM MANUAL Topical Report
T. F. Zupnik, E. N. Nilson, and V. J. Sarli 15 Sep. 1964 71 p refs
(Contract NAS3-2572)
(NASA-CR-54042; UACRL-C910096-11) OTS: $3.00 fs; $0.75 mf

The machine computational program numerically integrates the system of reaction-kinetic, gas-dynamic, and state equations to calculate compositions and thermodynamic properties in both subsonic and supersonic flow passages. A description is given of the equations and numerical techniques employed, and flow charts and specific instructions for input formats and operation of the machine program are presented. Also included is a discussion of possible operational problems that might arise prior to complete familiarization with the program, together with appropriate means for solving these problems and avoiding their recurrence. Author

N64-31756 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FLOW OF GAS IN THE CHANNEL OF AN AXIAL FRICTION TURBINE
K. K. Sokolov *In its* Theory, Design, Calculation, and Testing of Internal Combust. Engines 31 Jul. 1964 p 1–8 refs (See N64-31755 23-27)

The flow of turbine gas or steam through the annular channel of a friction turbine is analyzed by considering the nonstationary motion of a viscous incompressible liquid enclosed between two concentric cylinders of radii r_1 and r_2 revolving around a common axis with an angular velocity Ω_0 = const. The angular velocity of relative motion is introduced into the equation of motion, and it is demonstrated that for relatively small gaps (little difference between r_1 and r_2), the attenuation depends on kinematic viscosity, time, and gap. Consequently, an axial friction turbine should be made with a small relative channel height, and a gas or vapor of great density, (i.e., mercury vapor) should be used. M.P.G.

N64-31772 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON METHOD OF SMALL PERTURBATIONS IN PROBLEMS OF FLOW AROUND SLENDER BLUNT BODIES BY A HYPERSONIC FLOW OF GAS
V. V. Sychev 3 Sep. 1964 20 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 6, 1962 p 50–59
(FTD-MT-64-59; AD-605403)

The paper reports the construction of an approximate solution of the problem of flow around a slender blunt body on the basis of a single method of small perturbations. The basic idea consists of using the technique known as the Poincare–Lighthill–Kue (PLK) method. The use of PLK permits the construction of a solution uniformly valid in the entire flow, including the entropy layer. Displacement of body contours can be determined even in an enclosed form. A.W.

N64-32040 David Taylor Model Basin, Washington, D.C. Aerodynamics Lab.
EFFECT OF NOSE CONES AND FIN EXTENSIONS ON THE ZERO-LIFT DRAG OF A PRACTICE BOMB AT MACH NUMBERS OF 0.40 TO 1.03
Edward F. Kuklewicz and C. Thomas Hyle Aug. 1964 22 p refs
(DTMB-AERO-1078; AD-447867)

Transonic wind-tunnel tests were conducted to determine whether the Mk 106 Mod 2 practice bomb modified with various nose cones and fin tabs can be used to simulate the ballistic path and drag of the naval arsenal of bombs. The effect of the nose cones is to reduce the drag by one-third to one-half, depending on nose cone angle. The effect of the fin tabs is to increase the drag from two to three times depending on the fin tab length and inclination angle. Author

N64-32470 Republic Aviation Corp., Farmingdale, N.Y.
INVESTIGATION OF CONICAL AND FLAT PLATE BODIES AT HIGH REYNOLDS AND HYPERSONIC MACH NUMBERS
A. H. Lange 28 Jul. 1964 133 p refs
(RAC-2451)

Two slender cones, one circular and the other elliptic, a flat plate, and a number of bodies that were derived from these basic shapes by the addition of compression flares were tested at high Mach and Reynolds numbers in a hypersonic free-piston tunnel. Nitrogen was used as the test fluid. Mach numbers between 17 and 22 and Reynolds numbers between 3 and 1.5 million were achieved. Surface pressures, heat transfer, boundary layer profiles and shock locations were measured for the purpose of studying the effect of gas imperfections on the boundary layer under the various conditions imposed by the body shapes. The effects of viscous interaction, tip bluntness, and roughness on pressure and on heat-transfer distributions were investigated, and separation and transition were determined. Author

N64-32498 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
TANDEM GRID IN A SINGLE STAGE AXIAL BLOWER

H. Linnemann 21 Sep. 1964 21 p refs Transl. into ENGLISH from Konstruktion (W. Berlin), v. 16, no. 4, 1964 p 128–135 (RSIC-276; AD-606782)

In order to achieve high pressure factors in a single-stage axial blower, rotor and stator were equipped with tandem grids. Optimum arrangements of the partial grids were found for different ratios of the diameters. A comparison with the blade arrangements of single-row grids, which were designed for the same pressure and delivery factors, showed that tandem grid blading has better efficiency coefficients and a more advantageous position of the separation point. The tandem grids were especially advantageous in the case of relatively short blades. The pressure factor could be strongly varied through turning of the blades of the second rotor partial grid at an only slightly changed delivery factor, whereby the efficiency coefficient showed only small changes. Measurements in the flow behind the grids and observations of the boundary layers provided statements on the blade losses at tandem grids and at single-row grids. Author

N64-32649 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
SOME EFFECTS OF NOZZLE DIAMETER AND POSITION ON BASE DRAG FOR TWO CONCENTRIC NOZZLES AT SUPERSONIC MACH NUMBERS
K. L. Blackwell 17 Jun. 1963 87 p refs
(RF-TM-63-25; AD-449771)

An investigation was conducted to determine effects of various diameter concentric sustainer nozzles on base drag. The exit planes of these nozzles were positioned both forward and aft of the boost exit plane within the boost nozzle. Sustainer chamber pressure and Mach number were varied for each nozzle diameter and position. In addition to the basic configurations, data were taken for some cases where part of the sustainer flow was bled into the boost chamber. Data were taken mainly at Mach 2.5, with limited amounts of data being taken at 0 and 2.0. Basic data and computed drag values are presented for the above variables. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see:* 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-31589 Minnesota U., Minneapolis St. Anthony Falls Hydraulic Lab.
EXPERIMENTS ON A JET FLAP IN SUPERCAVITATING FLOW
Edward Silberman Jan. 1964 82 p refs
(Contract Nonr-710(50))
(TP-46, Ser. B; AD-443157)

Experiments on a fully cavitated, flat-plate hydrofoil equipped with a pure jet flap were conducted in a free-jet water tunnel. The foils were of 2-in. and 2.75-in. chord and were tested in 6-in.-, 10-in.-, and 14-in.-wide free jets. Data were obtained on the increments in lift, drag, and moment coefficients and on the shift in center of pressure as a function of jet momentum coefficient, cavitation number, and other variables. The experimental results were qualitatively similar to those obtained in fully wetted flow. Author

N64-31830 Minnesota U., Minneapolis St. Anthony Falls Hydraulic Lab.
TWO-DIMENSIONAL SUPERCAVITATING PLATE OSCILLATING UNDER A FREE-SURFACE Technical Paper No. 47, Series B.
C. S. Song Dec. 1963 64 p refs
(Contract Nonr-710(51))
(AD-603160)

The problem of a supercavitating flat plate at nonzero cavitation number oscillating under a free surface is analyzed by a linearized method using the acceleration potential. The flow is assumed two-dimensional and incompressible. The flow field is made simply connected by using a cut along the wake. The flow field is then mapped onto to an upper half plane, and the solution is expressed in an integral form by using Cheng and Rott's method. Equations for the cavity length, total force coefficient, moment coefficient, and the frequency-response function are expressed in closed form. Numerical results for some special cases are also obtained, and are presented graphically. An alternate analysis is carried out for the infinite fluid case, and the result shows that the effect of the wake assumption is of the order of the square of the cavitation number when the cavitation number is small. The effect of the gravity field is discussed qualitatively. It is concluded that the effect of the free-surface is to shorten the cavity and to increase the total force coefficient. Author

N64-31906 Lockheed-California Co., Burbank
INVESTIGATION OF ELASTIC COUPLING PHENOMENA OF HIGH SPEED RIGID ROTOR SYSTEMS Technical Report, Apr. 1962–Jun. 1963
John E. Yeates Ft. Eustis, Va., Army Transportation Res. Command, Jun. 1964 288 p refs
(Contract DA-44-177-TC-828)
(LR-17013; TRECOM-TR-63-75; AD-604030)

Some fundamental concepts of rigid rotor dynamics including decoupling are presented, as well as a 10-degree-of-freedom rotor stability analysis in hovering and a brief study of the static stability of the model. A dynamic helicopter wind-tunnel model having a 10-foot rotor diameter was constructed with three sets of blades and a hub, which allowed many variations in geometry and stiffness. Seven rotor configurations were tested in a full-scale tunnel, and two of these were tested to higher speeds and full-scale Reynolds number and Mach number in a transonic dynamics tunnel. The model and rotors and the testing technique are described; all the data collected are included. A principal focus of the program was the decoupled, or "matched blade," type of rigid rotor. Author

N64-32013 National Aeronautical Lab., Bangalore (India)
EXPERIMENTS ON THE USE OF SCREENS AND SPLITTERS IN A WIDE-ANGLE CONICAL DIFFUSER
K. N. Raju and D. M. Rao Apr. 1964 36 p refs
(TN-AE-24-64)

Experiments were carried out to study the effectiveness of several arrangements of screens for preventing flow separation in a conical diffuser of cone angle 38° and area ratio 15. Exit velocity profiles and pressure losses were measured for all the cases tested, and some favorable arrangements were obtained on this basis. An exploratory investigation of a splitter vane arrangement was also conducted for flow stabilization in the same diffuser. A comparison of the results obtained for the two systems indicates that the splitter vanes are at least as effective as the best screen arrangement for producing uniform exit flow and that they are potentially capable of yielding the desired degree of flow control, with substantially reduced pressure losses, by a careful optimization of the vane cluster geometry. Author

N64-32218 California U., Berkeley Inst. of Engineering Research
ANALYTICAL STUDY OF THE CHARACTERISTICS OF WEDGES IN SUPERSONIC VISCOUS FLOW
Ralph Ta-Shun Cheng 15 May 1964 44 p refs
(Contract Nonr-222(45))
(AS-64-8; AD-603319)

An analytical study of the normal and axial force coefficients of wedge-shaped airfoils in supersonic viscous flow is presented. It is based on the inviscid oblique shock relations to determine the flow conditions after the oblique shocks relations to determine the flow conditions after the oblique shocks in the vicinity of the wedge. This condition is used as the local free-stream condition, which is applied to the available correlation of compressible boundary-layer theory on a flat plate at zero angle-of-attack. The boundary-layer displacement thickness is used as the effective body in the inviscid supersonic small-perturbation theory to predict local surface pressure. Force coefficients are referred to the free-stream dynamic pressure and the area of the wedge base. Some numerical calculations have been carried out in order to compare the results with earlier theoretical and experimental data. Author

N64-32481 Ohio State U. Research Foundation, Columbus Aerodynamic Lab.
PRESSURES ON THE BLUNT PLATE WING AT SUPERSONIC AND HYPERSONIC SPEEDS
John D. Lee Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jul. 1964 32 p refs
(Contract AF 33(657)-10416)
(FDL-TDR-64-102; AD-606472)

Over wide ranges in Mach number, sweep angle, and attack angle, simple adjusted forms of Newtonian, Prandtl–Meyer, and blast-wave theories may be used to accurately predict the pressure distributions on blunt-edged flat plates, including the leading-edge regions. On the leading edge, Newtonian–Prandtl–Meyer flow may be adjusted with an empirical factor to fit available experimental data. For the plate surface, the blast-wave equation is modified by matching to the pressures at the cylinder-plate junction and on the infinite wedge, corresponding to the proper sweep and attack angle. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-31520 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TECHNICAL NEWS NOTES AND INTERESTING ITEMS IN AERONAUTICS
Jiri Kucera *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 73–76 (See N64-31513 23-17)

Brief résumés of the following news items are presented: (1) increase expected in the number of exhibitors at the 25th Air Exposition; (2) progress in the helicopter program at Sud-Aviation; (3) radio altimeters and monitors ordered for the VC-10 airplane; (4) maiden flight of the Jet Commander airplane; (5) liquidation suit against the West German carrier Continental Deutsche Luftreederei; (6) announcement of a new Lockheed helicopter, the XH-51A; (7) and FAA extension of the inspection interval to 3600 hours for Pratt and Whitney engines. M.P.G.

N64-31549* Meteorology Research, Inc., Altadena, Calif.
STUDY OF SPHERE MOTION AND BALLOON WIND SENSORS
Paul B. Mac Cready, Jr. and Henry R. Jex Huntsville, Ala. NASA. Marshall Space Flight Center, 27 Jul. 1964 46 p refs
(Contract NAS8-5294)
(NASA-TM-X-53089; MR164-FR-147) OTS: $2.00 fs; $0.50 mf

Balloons ascending in still air typically exhibit lateral movements that introduce errors when the balloons are tracked as sensors of wind motion. This report examines some of the fundamentals of the fluid flows and associated motions and net drag coefficients of free-moving spheres. The flows and motions depend directly on Reynolds number (R_d), which determines the flow regime; on the relative mass of the sphere to the fluid it displaces (RM) because, for a given R_d, the lower the RM values the greater the lateral motions and thus the larger the total wake size and drag; and on the sphere rotational inertia and minute details of surface roughness, sphericity, and random orientation. Because of these complex interactions no unique drag coefficient (C_D) vs R_d curve can be found for free-moving spheres. The separate effects of the main factors are described as they might affect an idealized C_D vs R_d curve for a perfectly smooth free-moving sphere of infinite RM. Author

N64-31694 Cook Electric Co., Morton Grove, Ill. Tech-Center Div.
STUDY AND EXPLORATORY FREE-FLIGHT INVESTIGATION OF DEPLOYABLE AERODYNAMIC DECELERATORS OPERATING AT HIGH ALTITUDES AND AT HIGH MACH NUMBERS
W. E. Nickel and L. W. Sims Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jul. 1964 154 p refs
(Contract AF 33(657)-8423)
(FDL-TDR-64-35, Vol. I; AD-606569)

Tests were accomplished over a Mach number range of 0.2 to 4.4 and an altitude range of 45 000 to 190 000 feet. The data presented include drag coefficients versus Mach number, dynamic pressure, Reynolds number and velocity, canopy angles of oscillation, canopy temperatures, and general design considerations. From this parachute decelerator test program, it may be concluded that Perlon mesh roof Hyperflo parachutes perform satisfactorily through Mach 2.1; that Nomex ribbon Hyperflo parachutes perform satisfactorily through Mach 4.0; and that Nomex Hemisflo parachutes perform satisfactorily through Mach 3.4. These Mach numbers apply in an altitude regime of 80 000 to 140 000 feet. The stainless-steel mesh roof Hyperflo parachutes were unsatisfactory, and the Perlon mesh roof Hyperflo at Mach 3.1 suffered complete canopy destruction due to aerodynamic heating. Author

N64-31877 General Motors Corp., Indianapolis, Ind.
AN EVALUATION OF LIFT ENGINES IN TACTICAL VTOL AIRCRAFT
Daniel H. Jacobson *In its* Allison Res. and Engr., Vol. 3, Third Quarter 1964, p 2–10 (See N64-31876 23-23)

The effectiveness of two VTOL propulsion systems—dual propulsion and vectored thrust—is evaluated with respect to short hover time and high cruise speed requirements of tactical aircraft. Dual propulsion combines vertical lift engines for takeoff and landing and separate propulsion engines for cruise. The vectored thrust system incorporates one or more engines whose thrust is diverted vertically for takeoff and landing, and redirected horizontally for forward flight. The

results of the comparative study have established a decided advantage in favor of the dual propulsion system. Cost comparisons and a discussion of lift engine design and technology are included. D.S.G.

N64-31903 Kellett Aircraft Corp., Willow Grove, Pa.
AN INVESTIGATION OF FLEXIBLE SKIRTS FOR GROUND EFFECT MACHINES Technical Report, Sep. 1962–Nov. 1963
R. C. Winter, A. A. Perlmutter, and R. R. Pruyn Ft. Eustis, Va., Army Transportation Res. Command, May 1964 147 p refs
(Contract DA 44-177-AMC-840(T))
(TRECOM-TR-64-18; AD-603517)

An experimental and analytical evaluation of skirts for an overland ground effect vehicle has been conducted. Skirt lengths up to 3 ft with plenum pressures up to 60 psf were investigated. Structural, performance, and stability analyses are presented and compared with model tests, two-dimensional skirt tests, and full-scale tests. The full-scale test rig consisted of a 5-ft-wide by 10-ft-long plenum GEM with 3-ft-long skirts. Testing included performance, obstacle, and stability tests at 60-psf plenum pressure. Author

N64-31931 Dynasciences Corp., Fort Washington, Pa.
INVESTIGATION OF AN ELECTROMAGNETIC INTERFERENCE-FREE ACTIVE STATIC DISCHARGING TECHNIQUE FOR FIXED AND ROTARY WING AIRCRAFT Final Report, May–Dec. 1963
Juan de la Cierva, David L. Heller, and Paul B. Wilson, Jr. Wright-Patterson AFB, Ohio, AF Avionics Lab., Aug. 1964 99 p refs
(Contract AF 33(657)-11597)
(DCR-131; AL-TDR-64-35; AD-605947)

An active electrostatic discharger was designed and constructed for the elimination of electrostatic charges from aircraft. This discharger maintains the charge potential of any type of aircraft at a very low level. The radio-frequency interference generated by the corona discharge through the active discharger is very much lower than the interference generated by discharge from an aircraft equipped with passive dischargers. Corona discharge probes for use with active electrostatic dischargers were studied with regard to their current and rf interference characteristics. Characteristics of numerous probe designs were evaluated through wind-tunnel tests. A reduction of 40 to 60 dB, dependent upon frequence and conditions in the rfi noise due to static charge buildup in helicopters, can be anticipated by using active discharging techniques. Author

N64-31951 Autonetics, Anaheim, Calif.
GUST ALLEVIATION FEASIBILITY STUDY Final Report
John D. Balducci, F. Le Roy Adams, and Milton A. Schwartzberg Ft. Eustis, Va., Army Transportation Res. Command, Apr. 1964 226 p refs
(Contract DA-44-177-AMC-858(T))
(TRECOM-TR-64-1; AD-605841)

Analytical effort provides information for appraisal of capabilities and feasibility of known gust alleviation systems as applied to high subsonic operations. Gust alleviation systems are defined as methods that intentionally or incidentally reduce vertical aircraft loading due to turbulence. Evaluation criteria include alleviation capability, pilot tolerance and endurance, stability, control, performance, structural effects, weight, cost, reliability, and fail-safety. Author

N64-31952 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
MEASUREMENT PROGRAM TO DETERMINE STATIC ELECTRICITY CHARGING CURRENTS IN HELICOPTER MAIN ROTOR BLADES Technical Report, Jun. 1962–Aug. 1963
S. Baron, E. Cholakian, and T. Coonan Ft. Eustis, Va., Army Transportation Res. Command, Jun. 1964 43 p refs
(Contract DA44-177-TC-844)
(TRECOM-TR-64-14; AD-605828)

An SH-3A main rotor blade was electrically insulated from the rotor head and connected to measuring apparatus to determine to what extent the main rotor blades contributed to the electrostatic charges on helicopters. Testing was performed on test stands and on an SH-3A helicopter in various environmental conditions. It was found that in clear-air conditions (no snow, sand, rain, etc.) electrostatic charging current due to main rotor blades is relatively small compared to the helicopter's total current; however, in environmental conditions (snow, sand, rain, etc.) the main rotor blades are the major contributors of electrostatic charging current. Author

N64-32139 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
3-D MOTION FOR AN AIRCRAFT SIMULATING AN ICBM
William L. Shepherd and Thomas M. Mc Calla, Jr. Oct. 1963 28 p refs
(ERDA-81; AD-422454)

Three-dimensional differential equations of motion for a ballistic body are formed, which include the effects of coriolis and reentry drag. Expressions for the initial conditions of the 3-D equations in terms of a 2-D model are derived. The angular position and angular rates of the ICBM with respect to the tracking radar determine the aircraft position and velocity required to simulate the ICBM. Author

N64-32148 General Electric Co., Cincinnati, Ohio Advanced Engine and Technology Dept.
XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT Quarterly Technical Progress Report, 16 Nov. 1963–15 Feb. 1964
[1964] 19 p
(Contract DA-44-177-TC-715)
(QTPR-9; AD-447839)

Propulsion system support was provided during aircraft ground tests. Preparation for a full-scale wind-tunnel test was completed in terms of detail test plan, instrumentation, test fixtures, and data reduction program. Author

N64-32297 Bell Aerosystems Co., Buffalo, N.Y.
X-22A TRI-SERVICE V/STOL AIRCRAFT Monthly Progress Report No. 7, 1–30 Jun. 1963
A. J. Marchese 15 Jul. 1963 48 p
(Contract NOw-63-0118-ci)
(Rept.-2127-933007; AD-442728)

Final design resolutions are being made, incorporating revisions for improved longitudinal and directional stability. Flight-control-system design weight has been established, and additional weight-control studies are continuing. Wind-tunnel tests of the 1/5-scale powered model and the 1/6-scale unpowered model are progressing. Testing of wing compression test panels has started, and assembly of duct noise and fuselage shear test specimens is proceeding. Subcontractor coordination and PERT scheduling and management control are continuing. M.P.G.

N64-32298 Bell Aerosystems Co., Buffalo, N.Y.
X-22A TRI-SERVICE V/STOL AIRCRAFT Monthly Progress Report No. 9, 25 Jul.–31 Aug. 1963
A. J. Marchese 15 Sep. 1963 49 p
(Contract NOw-63-0118-c)
(Rept.-2127-933009; AD-442887)

System configurations based on the aircraft freeze and wind-tunnel test results available have been established, and effort is now progressing in layouts and details for fabrication. Weight control program effort is continuing. Prime effort in the wind-tunnel test program was centered on the 1/7-scale flutter model, which to date reflects satisfactory results. The fuselage shear test specimen tests were completed satisfactorily, and tests are in process on the duct noise specimens. Author

N64-32419 Bell Aerosystems Co., Buffalo, N.Y.
X-22A TRI-SERVICE V/STOL AIRCRAFT Monthly Progress Report No. 4, 1–31 Mar. 1963
A. J. Marchese 15 Apr. 1963 47 p
(Contract NOw-63-0118-ci)
(Rept.-2127-933004; AD-442867)

Preliminary design work, performance and weight studies, and calculation reviews of various configurations that are in progress are being reduced to the detail systems and component levels. The wind-tunnel program, design, fabrication, and test is essentially on schedule. The Escapac ID (BA) seat was selected for use on this aircraft. All contractual data requirements were completed as scheduled. Author

N64-32420 Bell Aerosystems Co., Buffalo, N.Y.
X-22A TRI-SERVICE V/STOL AIRCRAFT Monthly Progress Report No. 5, 1–30 Apr. 1963
A. J. Marchese 15 May 1963 41 p
(Contract NOw-63-0118-ci)
(Rept.-2127-933005; AD-442715)

Preliminary design work, performance, and weight studies, and calculation reviews of various configurations have been reduced to designs for all systems and components. The wind-tunnel-program design, fabrication, and test is being revised to reflect necessary redesigns as a result of the 1/6-scale-model test data. The transmission systems (gearboxes and shafting) have been reviewed, and the evaluation is in its final phase. Author

N64-32423 Northrop Corp., Newbury Park, Calif. Ventura Div.
WIND TUNNEL TEST PROGRAM FOR TESTS OF 12 FT. D_o MODELS OF A.S.D. STEERABLE PARACHUTE
V. F. Riley and E. M. Linhart 8 Nov. 1963 17 p
(Contract AF 33(657)-10648)
(PTM-754; AD-442743)

A wind tunnel test plan is presented for the testing of 12-ft D_o gliding parachute models. These tests are to be conducted in a 40 × 80 ft wind tunnel. Tests will be conducted with five model configurations and one cluster configuration. Two models will be tested to obtain loads for the reefed canopy condition as a function of q and percent reefing. Author

N64-32447 Mississippi State U., State College
FLOW-VISUALIZATION TECHNIQUES USED IN FULL-SCALE FLIGHT TESTS Aerophysics Research Report No. 49
Sean C. Roberts and Michael R. Smith Ft. Eustis, Va., Army Transportation Res. Command, Jul. 1964 32 p
(Contract DA-44-177-AMC-892(T))
(TRECOM-TR-64-39; AD-605848)

This report presents a description and evaluation of various flow visualization techniques that are now available for use in full-scale flight. The techniques described are adequate to determine the surface flow conditions, as well as the potential flow field around and behind aircraft as a function of time. Author

N64-32551 Bell Aerosystems Co., Buffalo, N.Y.
A GENERALIZED EXPERIMENTAL STUDY OF INLET TEMPERATURE RISE AND LIFT-THRUST OF JET VTOL AIRCRAFT IN GROUND EFFECT
B. A. Zeganoski 15 Jun. 1964 84 p refs
(Contract N600(19)-58526)
(Rept.-2099-928002; AD-447906)

A variable engine location model was designed, fabricated, tested, and the data analyzed and correlated so that effects of turbojet engine inlet–exhaust locations can be evaluated. The temperature rise of engine inlet air due to recirculation and ingestion of the hot exhaust gases was determined by operating various model configurations within ground effect. Model net lift (or vertical thrust) within and above ground effect also was measured. Inlet temperature rise was transformed into engine thrust loss, and the total change in lift (or vertical thrust) within ground effect was obtained in order to permit design for minimum total VTOL thrust-lift losses. A network of thermocouples also was installed to give information on the flow field temperature adjacent to the model. Author

N64-32595 Ryan Aeronautical Co., San Diego, Calif.
FLEXIBLE WING INDIVIDUAL DROP GLIDER Final Report, Jul. 25–Nov. 21, 1962
B. E. Kurz Ft. Eustis, Va., Army Transportation Res. Command, 21 Jul. 1963 173 p
(Contract DA-44-177-TC-827)
(TRECOM-TR-63-26; AD-420814)

The results of an experimental development and test program of an inflatable flexible-wing individual drop glider is presented. System operation and wing packing procedures are discussed. Aerodynamics, loads, design, stress, weights, and test data, such as deployment shock loads and accelerations, glide performance, and landing velocities and shock loads, are given. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics, and 29 Space Sciences.

N64-31559* Consultants and Designers, Inc., Arlington, Va.
RESULTS OF MEASUREMENTS IN THE 70.16 CM WAVELENGTH OF RADIO EMISSION INTENSITY OF A SERIES OF DISCRETE SOURCES, THE MOON AND JUPITER [REZUL'TATY IZMERENIY INTENSIVNOSTI RADIOIZLUCHENIYA RYADA DISKRETNYKH ISTOCHNIKOV, LUNY, I YUPITERA NA VOLNE 70.16 CM]
A. V. Zakharov, V. D. Krotikov, V. S. Troitskiy, and N. M. Tseytlin 6 Oct. 1964 6 p refs Transl. into ENGLISH from Izv. Vysshikh Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 7, no. 3, 1964 p 553–555
(Contract NAS5-3760)
(NASA-TT-F-8966; ST-LPS-RWP-10215) OTS: $1.00 fs; $0.50 mf

Radio emission measurements of discrete sources relative to Cassiopeia-A were conducted by a series of observers, and included those in the vicinity of 70-cm wavelength. However, in compiling the catalog of discrete sources spectra, investigations by precision measurements of the most powerful sources with the "artificial Moon" method are required, and their subsequent comparison with the weakest sources. The current measurements of emission intensity of discrete sources

are meant for a partial solution of this problem. Temperature measurements of radio emissions from the Moon and Jupiter are more precise than the available sparce experimental data in the wavelengths $\lambda \sim 70$ cm. Author

N64-31561* Consultants and Designers, Inc., Arlington, Va.
RESULTS OF MEASUREMENTS OF MOON'S RADIO EMISSION IN THE 1.6 CM WAVELENGTH [REZUL'TATY IZMERENIYA RADIOIZLUCHENIYA LUNY NA VOLNE λ = 1.6 CM]
D. A. Dmitrenko, S. A. Kamenskaya, and V. L. Rakhlin 6 Oct. 1964 4 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiofiz. (USSR), v. 7, no. 3, 1964 p 555–556 Presented at the VIth All-Union Conf. on Radioastronomy, Gor'kiy, 1963
(Contract NAS5-3760)
(NASA-TT-F-8968; ST-LPS-10217) OTS: $1.00 fs; $0.50 mf

Measurements of the moon's radio emission in the 1.6-cm wavelength were made during the hours nearest the moon's culmination. The radiotemperature of the moon was found by using the formula $T_{MF} = (n_M/n_D)\, dT_D e^{-\Delta\gamma}$. The phase dependencies of the moon's radiotemperature are approximated by the expression: $T_{MF} = 207° + 33° \cos(\omega t - 8°)$ and $T_{MF} = 207° + 34° \cos(\omega t - 18°)$. The error in the value of the variable component is ±4%, and in the determination of the constant component it is not greater than ±3%. Error in the determination of the phase is near 10° to 20° A.W.

N64-31569* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW SPECTRA OF SYMBIOTIC STARS
Francois V. Dosson Repr. from Astron. J., v. 69, no. 2, Mar. 1964 1 p
(NASA-RP-268)

The spectroscopic observation of symbiotic stars was extended in two ways. One way of extension was by increasing the resolution in the ordinary range of wavelength, and the second way was by extending the spectroscopic investigation to the photographic infrared. The best spectra were obtained for Z Andromedae in the photographic region, and for BF Cygni in the infrared. These spectra were extensively studied, and the results are summarized. D.E.W.

N64-31725* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE REDUCED THREE-BODY PROBLEM: A GENERALIZATION OF THE CLASSICAL RESTRICTED THREE-BODY PROBLEM
Gary P. Herring 16 Jul. 1964 22 p ref
(NASA-TM-X-53088) OTS: $1.00 fs; $0.50 mf

The restricted three-body problem is generalized to include the motion of the earth and moon on coplanar Keplerian ellipses of eccentricity ϵ, $(0 \leq \epsilon < 1)$. The equations of motion are written in a space fixed-coordinate system. After accomplishing a normalization of the equations in this system, the normalized equations are transformed to a rotating coordinate system. Transformations of the results to several other systems of interest are given. Author

N64-31727* National Aeronautics and Space Administration, Washington, D.C.
REFINEMENT OF THE ASTRONOMICAL UNIT ON THE BASIS OF THE RESULTS OF RADAR OBSERVATIONS OF THE PLANET VENUS IN 1961 [UTOCHNENIYE ASTRONOMICHESKOY YEDINITSY PO REZUL'TATAM RADIOLOKATSII PLANETY VENERA V 1961 G]
V. A. Kotel'nikov, B. A. Dubinskiy, M. D. Kislik, and D. M. Tsvetkov Oct. 1963 10 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 17, 1963 p 101–106
(NASA-TT-F-8532) OTS: $1.00 fs; $0.50 mf

The determination of the astronomical unit at the Institute of Radio Engineering and Electronics of the Academy of Sciences of the U.S.S.R. was A = (149 599 300 ±2000) km. The method used is described. Compared with values derived by observers in the U.S. and Great Britain, also of the basis of radar observations of Venus in 1961, the maximum difference does not exceed 2300 km. R.L.K.

N64-31738 Liege U. (Belgium)
THE LUMINOSITY VARIATIONS OF COMET HEADS Technical Note No. 6
L. Remy-Battiau 20 Aug. 1964 17 p refs
(Contract AF 61(052)-587)
(AFCRL-64-746; AD-606655)

Whitney's work has been reexamined under the assumption that the light emitted at the time of an outburst is due to scattering (instead of reflection) of solar radiation by small solid particles. It is assumed that these particles are spherical and of refractive index, respectively 1.50 (radius 10^{-3}, 10^{-4}, and 10^{-5} cm) and 1.38 to 1.49 i (radius 10^{-4} and 10^{-5} cm). The masses required to explain the luminosities of the halos are of the same order as those computed by Whitney. Hence, the required energies are also of the same order as those in Whitney's paper. Our main conclusion agrees with Whitney's—it is very unlikely that solar particles are directly responsible for cometary outbursts. Author

N64-31973 RAND Corp., Santa Monica, Calif.
STABILITY OF THE TROJAN POINTS IN THE FOUR-BODY PROBLEM
H. B. Schechter and W. C. Hollis Sep. 1964 111 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3992-PR; AD-606232)

This memorandum investigates the positional stability of possible dust clouds in the vicinity of the earth-moon Trojan libration points by solving for the motion of their centers of mass in the presence of earth, moon, and sun. A restricted four-body model is considered, in which earth and moon are assumed to move along circular orbits. The lumped mass of the dust cloud is treated as the infinitesimal particle. The general restricted four-body equations of motion of a particle in the combined force fields of earth, moon, and sun are set up in the usual rotating, baricenter-attached, coordinate frame of the restricted three-body problem. Author

N64-32128 Joint Publications Research Service, Washington, D.C.
NEW ASTROPHYSICAL LABORATORY AT PULKOVO
L. A. Mitrofanova 7 Oct. 1964 15 p Transl. into ENGLISH from Priroda (Moscow), no. 8, 1964 p 44–50
(JPRS-26769; TT-64-51026) OTS: $1.00

The history of the laboratory is given. Research work is briefly described in the following areas: vacuum spectrographs with diffraction grating; spectrographs with concave diffraction grating; the behavior of spectral lines in magnetic fields; and the optical tunnel. A.W.

N64-32342 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.
LIBRATION OF THE CLOSE APPROACHES OF PLUTO TO NEPTUNE
C. J. Cohen and E. C. Hubbard 3 Aug. 1964 17 p refs
(NWL-1945; AD-603463)

The orbits of the five outer planets were computed by special perturbations over 120 000 years. There was revealed a remarkable libration of the close approaches of Pluto to

Neptune such that the distance between the bodies is never less than 18 au. The mechanism of the libration is described. It is concluded that the orbit of Pluto is safe from very close approaches to Neptune, and no particular instability results from the fact that the radius of perihelion of Pluto is less than the radius of the orbit of Neptune. The libration is characterized by an oscillation in the angle, $3l_P - 2l_N + \tilde{\omega}_N - \tilde{\omega}_P) - 180°$. The period of the oscillation is about 19 670 years and the amplitude is about 76°. Author

N64-32371 Case Inst. of Tech., Cleveland, Ohio Warner and Swasey Observatory
INTRINSIC PROPERTIES OF GIANT M STARS, II
Victor M. Blanco 28 Oct. 1963 6 p refs
(Contract Nonr-3403(00))
(AD-421709)

Photometric and spectroscopic observations were made in four areas of the sky within 30-hr periods and, in two cases, within 4-hr periods. A total of 234 M stars were observed for color indices and spectral types. For variability studies, two areas were selected and a total of 95 stars were studied. Mean intrinsic colors found are presented in a tabular summary. Variability characteristics studied in the two areas showed no significant differences, and the information for the two areas was therefore combined. Only nine stars showed definite light curves typical of long-period variables. The total results according to spectral class are presented in tabular summary. A.W.

N64-32477 Paris Observatory, Meudon (France).
POLARIMETRIC OBSERVATIONS OF PLANETS AND SATELLITES Annual Summary Report No. 3, 1 Jun. 1963–31 May 1964
Audouin Dollfus and Maurice Marin 30 Jun. 1964 21 p
(Contract AF 61(052)-508)
(AFCRL-64-693; AD-606651)

The adaptation of a near infrared polarimeter on the 40-in. reflector and its use for planetary measurements is discussed. The final goal of the work with the polarimeter is to determine the curves of polarization of the planets, as a function of the phase angle, which are characteristic of their physical properties. The curves are compared with those obtained on terrestrial samples. Some measurements have been collected on Jupiter, Venus, and the Moon. The formulas for final computation, taking account of the calibration of the polarimeter, are given. P.V.E.

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-31402 Minnesota U., Minneapolis Plasma Physics Research Lab.
BASIC PHENOMENA IN THERMIONIC ENERGY CONVERTERS Final Report, Feb. 1, 1961–Nov. 1, 1963
H. J. Oskam Jun. 1964 42 p refs
(Contract AF 19(604)-8072)
(AFCRL-64-560; AD-603964)

This report summarizes studies of a few phenomena related to the physics of thermionic energy converters, as well as the processes responsible for the high efficiency of the hollow-cathode discharge. Machine computations of the transport of charged particles under the influence of both electric fields and density gradients, while allowing for a changing particle energy, revealed the possibility of ionization of neutral particles by electrons having traversed a voltage difference smaller than the ionization potential of the neutral particles involved. The theoretical results obtained are compared with experimental data. A systematic study of the current–voltage characteristics of a plane and hollow-cathode discharge led to a considerably better insight into the significance and magnitude of the hollow-cathode discharge mechanism. Author

N64-31454* Livingston Electronic Corp., Montgomeryville, Pa.
DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES 200 WATT HOURS PER POUND TOTAL BATTERY WEIGHT MINIMUM Final Report
William F. Meyers [1963] 138 p refs
(Contract NAS3-2775)
(NASA-CR-54083) OTS: $4.00 fs; $1.00 mf

A detailed listing of 99 flat plate cell tests is given. Two cells gave energy densities of 125 and 102 Whr/lb of total battery weight. A method of interrelating the most significant properties of potential electrolytes into a figure of merit anticipating battery performance was evolved. Nine solvents with high figures of merit were selected for more intensive consideration. Automatic cell discharge and complex recording equipment were designed and constructed to accelerate the study of electrochemical systems. Insertion of the physicochemical values for water into the energy balance produced an unexpectedly high figure of merit due to the ionization constant of water. Aqueous cells constructed with alkaline anolytes and acid catholytes provided more than 4 V until the cathode membranes failed under acid oxidation. Since cathodes are generally the limiting factor in the majority of batteries, several approaches were examined in an effort to make available improved oxidants for electrochemical use. R.L.K.

N64-31456* American Cyanamid Co., Stamford, Conn. Research Labs.
RESEARCH AND DEVELOPMENT OF HIGH-PERFORMANCE LIGHT-WEIGHT FUEL CELL ELECTRODES Third Quarterly Report, May 1–Jul. 31, 1964
R. G. Haldeman, W. P. Colman, D. Gershberg, and J. D. Ward 15 Sep. 1964 107 p refs
(Contract NAS3-2786)
(NASA-CR-54171) OTS: $4.00 fs; $0.75 mf

The overall object of this contract is the reduction of the weight-to-power ratio of the hydrogen–oxygen fuel cell. Work has been concentrated on exploration of the operating range of cells made up with standard and high-loading electrodes in combination with fuel cell and asbestos matrices. Extensive life-testing was also conducted, and factors contributing to performance decline were investigated. A 6 × 6 in. active area test cell was designed and constructed. Theoretical analysis was made of the electrolyte concentration and temperature gradients to be expected in a fuel cell operating with dynamic heat and water removal and with no auxiliary cooling. Author

N64-31610 General Electric Co., Philadelphia, Pa. Missile and Space Div.
LARGE TURBO-NUCLEAR SPACE POWER SYSTEMS
M. A. Zipkin *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 201–259 (See N64-31601 23-27)

A 1-megawatt system is discussed in detail. In identifying and optimizing the configuration, the effects of the following

major parameters were considered and evaluated: reactor and shielding, radiator, power conversion, electric-propulsion engine, and launch vehicle. The thermodynamic design is based upon use of the Rankine cycle, employment of an isolated pressurized-liquid reactor-coolant flow loop for transfer of reactor heat to the turbine fluid vapor generator, employment of a jet-condenser type of heat-rejection system, selection of potassium as the turbine working fluid, and selection of lithium as the reactor coolant. Briefly described are the major components of the system—the heat exchanger boiler, the main turbogenerator, the jet condenser and pump unit, and the waste-heat radiators. Total weight of the system was estimated to be 8900 pounds, including shielding adequate for unmanned application. A brief outline is given of recent technological advances in the areas most critical for large space-power systems: suitable containment materials for high-temperature alkali metals in the space environment, two-phase phenomena of the alkali metal working fluids, reliable and stable liquid-metal lubricated bearings, and nearly "zero-leakage" seals. Individual components for the system are being developed, and programs are described for the turbine, pumps, and boiler. R.L.K.

N64-31611 Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

MHD POWER GENERATION: PROMISES AND PROBLEMS

T. C. Tsu and L. S. Frost *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 261–269 refs (See N64-31601 23-27)

As a consequence of the fact that the MHD process is a volume process, the voltage output of an MHD generator is proportional to the gas velocity, the magnetic flux density, and a linear dimension. Almost any desired voltage-current characteristics can be obtained by making the duct thinner or fatter, shorter or longer. MHD generators lend themselves to high temperatures and, therefore, high thermodynamic cycle efficiency that, in turn, leads to small size and low weight of the heat source and the heat sink. The absence of moving structural parts leads to low stresses and low weight. Current research problems involve plasma conductivity, strong magnetic fields, and real machine effects. R.L.K.

N64-31612 General Electric Co., Philadelphia, Pa.

THERMIONIC-NUCLEAR SPACE POWER SYSTEMS

Herman Miller *In* AFOSR Advanced Propulsion Concepts, Vol. 1 p 271–289 (See N64-31601 23-27)

The thermionic conversion process is described. The combination of thermionic converter and a nuclear heat source is a natural one, since nuclear fuel can and does operate at the temperature required for emitter heating. Also, heat-generation rates and heat-transfer conditions that are required for converter operation are well matched to those demonstrated for nuclear fuel. In addition, the thermionic converter is a relatively efficient heat engine that operates at a high heat-rejection temperature; the high efficiency favors a small reactor heat source, and the efficiency and high heat-rejection temperature favor compactness in the balance of the system. Four basic nuclear thermionic power systems are reviewed briefly—reactor with thermionic convertors on its outer surface and cooled by direct radiation, reactor with integral thermionic fuel elements and cooled by forced convection of liquid metal, separate reactor cooled by liquid metal and with the converters on the surface of the heat exchanger between the reactor cooling loop and the radiator loop, and separate reactor cooled by liquid metal and with converters on the surface of the radiator. R.L.K.

N64-31633 Aerospace Corp., El Segundo, Calif. Electronics Div.

A QUANTIZED DATA ATTITUDE CONTROL SYSTEM

P. R. Dahl, V. R. Brenes, and H. Sokoloff 24 Jun. 1964 63 p refs

(Contract AF 04(696)-269)

(SSD-TDR-64-104; TDR-269(4116-46)-1; AD-448063)

A space vehicle attitude-control system that utilizes a quantized attitude error signal is presented. Analyses of system operation are presented, including the general solution for the lead network response to a uniform staircase input. The staircase solution is used to derive expressions for the single pulse on and off switching lines in the phase plane. Envelopes of the single pulse on and off switching lines are shown to describe the regions of pulsing torque application. Acquisition and limit cycle modes of operation are analyzed to determine the nature of the response trajectories. Although the control system is quite simple in philosophy and mechanization and does not require mode switching, it is shown to have desirable response characteristics over its entire dynamic operational range. Author

N64-31699* General Electric Co., Schenectady, N.Y.

FLUID AMPLIFIER STATE OF THE ART. VOLUME I: RESEARCH AND DEVELOPMENT—FLUID AMPLIFIERS AND LOGIC

P. L. Abbey et al Washington, NASA, Oct. 1964 283 p refs

(Contract NAS 8-5408)

(NASA-CR-101) OTS: $4.00

The report surveys the current state-of-the-art of fluid amplifiers, including both theoretical and practical aspects of devices having no mechanically moving parts. It is based on a complete review of the published literature (with an extensive bibliography) and on information obtained from organizations involved in fluid amplifier development. Specific areas covered are design techniques, both analytical and experimental; typical elements and assemblies; applications, both now in use and contemplated; fabrication techniques; and instrumentation. Author

N64-31700* General Electric Co., Schenectady, N.Y.

FLUID AMPLIFIER STATE OF THE ART. VOLUME II: BIBLIOGRAPHY

Washington, NASA, Oct. 1964 124 p refs

(Contract NAS 8-5408)

(NASA-CR-102) OTS: $2.75

The search was limited to no-moving-part fluid devices and representative sources for basic technology. The period from 1935 to the present was covered. Particular effort was made to find references in the Russian literature in view of reports that the fluid devices are being applied in their missiles. The bibliography includes 317 references, of which 210 have been abstracted. No appreciable effort was identified in the period from 1935 until early 1960; most of the references have appeared during the last two-and-a-half years. There was almost no specific information on Russian progress in this field. Author

N64-31709 Dynatech Corp., Cambridge, Mass.

SUPPORTING TESTS FOR A SUPERCONDUCTING, ROTATING, ELECTRIC GENERATOR Second Quarterly Progress Report

E. H. Sibley, E. F. Doyle, and C. J. Oberhauser Oct. 1963 28 p refs

(Contract AF 33(657)-11062)

(Rept.-428; AD-421061)

The object of this investigation is to determine the feasibility of the application of superconductor technology to the generation of electrical power by rotating electromagnetic devices. Since the anticipated use of such a generator is for long missions, a refrigerator with associated equipment must be considered part of the package. The work includes analytical and design studies of both electrical and mechanical components. The program may be divided into three parts—initial design, supporting tests, and final design. This report deals with the initial phases of the supporting tests. Author

N64-31713* Lear Siegler, Inc., Cleveland, Ohio Power Equipment Div.
BRUSHLESS ROTATING ELECTRICAL GENERATORS FOR SPACE AUXILIARY POWER SYSTEMS, VOLUME I Third Quarterly Report
J. N. Ellis and F. A. Collins 15 Jul. 1964 428 p
(Contract NAS3-2783)
(NASA-CR-54101) OTS: $7.00 fs; $2.00 mf

Design manuals and FORTRAN computer programs are presented for the following ac generators: (1) two-coil, inside-coil Lundell or Becky–Robinson generator; (2) two-coil, outside-coil Lundell; and (3) single-coil, outside-coil Lundell. P.V.E.

N64-31714* Lear Siegler, Inc., Cleveland, Ohio Power Equipment Div.
BRUSHLESS ROTATING ELECTRICAL GENERATORS FOR SPACE AUXILIARY POWER SYSTEMS, VOLUME 2 Third Quarterly Report
J. N. Ellis and F. A. Collins 15 Jul. 1964 421 p
(Contract NAS3-2783)
(NASA-CR-54101) OTS: $7.00 fs; $2.00 mf

Design manuals and FORTRAN computer programs are presented for the following ac generators: (1) rotating-coil Lundell (automotive type); and (2) inside-coil, stationary-coil Lundell. Included is a design manual for permanent-magnet ac generators. P.V.E.

N64-31715* Lear Siegler, Inc., Cleveland, Ohio Power Equipment Div.
BRUSHLESS ROTATING ELECTRICAL GENERATORS FOR SPACE AUXILIARY POWER SYSTEMS, VOLUME 3 Third Quarterly Report
J. N. Ellis and F. A. Collins 15 Jul. 1964 270 p
(Contract NAS3-2783)
(NASA-CR-54101) OTS: $6.00 fs; $1.25 mf

Design manuals are presented for: (1) homopolar inductor as generators; and (2) a disk-type or axial airgap Lundell generator. Also included is an equivalent circuit representation of synchronous ac generators with a discussion of its development. P.V.E.

N64-31716* Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL CONDENSING-FLOW STABILITY STUDIES
S. S. Wyde and H. R. Kunz 15 Apr. 1964 136 p ref
(Contract NAS3-2335)
(NASA-CR-54178; PWA-2315) OTS: $4.00 fs; $0.75 mf

In downflow testing, slugging of the condensing steam flow inside the tubes of the Rankine-cycle space powerplant caused pressure oscillations and possible pump cavitation. By use of various cooling inserts in the condensing-tube exits, the magnitude of the oscillations was reduced. G.G.

N64-31878 General Motors Corp., Indianapolis, Ind.
RESEARCH IN THERMIONIC ENERGY CONVERSION
D. L. Dresser, D. R. Zimmerman, and J. D. Dunlop *In its* Allison Res. and Engr., Vol. 3, Third Quarter 1964 p 11–29 refs
(See N64-31876 23-23)

The experimental approaches and devices presently being used in the thermionics research program are described. Some cesiated work function measurements on tungsten with a 110 crystal orientation and on rhenium made by chemical vapor deposition are reported as new contributions to the literature of emitter materials. The discussion includes a review of the physics of thermionic energy conversion, surface studies on refractory metal emitter materials, a description of the flexible laboratory thermionic converter for research, and recent results obtained on two converters with tungsten and rhenium emitters. D.S.G.

N64-31929 Gulton Industries, Inc., Metuchen, N.J. Alkaline Battery Div.
LITHIUM-NICKEL HALIDE SECONDARY BATTERY INVESTIGATION
A. E. Lyall and H. N. Seiger 16 Sep. 1964 22 p
(Contract AF 33(615)-1266)
(QTPR-3; AD-605754)

Polarization tests have been obtained for the nickel fluoride cathode. These data indicate a high degree of polarization on both charge and discharge. Improvements in both the polarization and utilization of the nickel chloride cathode have been achieved. Electrochemical formation greatly improves utilization. The lithium anode has been found to be satisfactory and is not a limiting factor at present. Examination of a laboratory cell after cycling is discussed. A precipitate formed in the electrolyte on cycling has been found to be 2% aluminum and 35% chlorine. This combination does not bear out the hypothesis of a hydrolized aluminum chloride since the ratio of chlorine to aluminum is too great. Author

N64-32021* Battelle Memorial Inst., Columbus, Ohio
ALPHA-CELL DIRECT-CONVERSION GENERATOR
A. M. Plummer, W. J. Gallagher, R. G. Matthews, and J. N. Anno 19 Aug. 1964 68 p refs
(Contract NAS3-2797)
(NASA-CR-54162) OTS: $3.00 fs; $0.50 mf

The report contains eight chapters on the theory of alpha-cell operation; four chapters on experimental studies with an alpha-cell direct-conversion generator; and summaries of work performed to date and work to be performed in the future. A.W.

N64-32086 American Machine and Foundry Co., Alexandria, Va.
DEVELOPMENT OF A SOLID STATE ELECTRICAL DISTRIBUTION SYSTEM Final Report, 1 Apr. 1962–12 Jul. 1963
R. N. Stock and R. W. Powell Wright-Patterson AFB, Ohio. Air Aero-Propulsion Lab., Oct. 1963 270 p refs
(Contract AF 33(657)-8688)
(ASD-TDR-63-805; AD-422380)

Two transmission links of the F-106B were redesigned as solid-state systems to demonstrate the feasibility of solid-state transmission links. The solid-state systems used controlled rectifiers and power transistors as power handling devices. An interesting aspect of the system was that relatively few types of devices were needed to implement a variety of functions. These functions included power switches, control circuits, power supplies, and circuit breakers. The solid-state system

were tested over the temperature range of −55° to +80° C, and results were good. Author

N64-32090 Eagle-Picher Co., Joplin, Mo. Couples Dept.
INVESTIGATIONS LEADING TO THE DESIGN OF A RELIABLE SEALED NICKEL-CADMIUM CELL Final Report, May 1, 1962–Apr. 30, 1963
E. B. Cupp 31 May 1963 29 p
(Contract DA-36-039-SC-89084)
(Rept.-4; AD-421035)

Studies of various cell components were made and are evaluated. Charge retention studies are detailed and demonstrate the influence of temperature and time on the degradation of capacity in both positive and negative plates. Both types of plates illustrated the ability to retain at least 70% of original capacity after 6 months' storage at +90° F. The effects of addition agents, such as lithium and zinc, are recorded, and definite influence is shown under fixed conditions of charge and discharge. Author

N64-32197 Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
DESIGN OF HYDROGEN-OXYGEN CAPILLARY TYPE FUEL CELL Quarterly Technical Progress Report, 1 May–30 Jul. 1964
J. C. Prestridge, ed. 14 Aug. 1964 20 p
(Contract AF 33(615)-1185)
(QTPR-3; AD-604114)

The package was subjected to a successful vehicle systems operational test. Work on the 28-V fuel cell power system and the fuel cell analyzer is progressing. Information acquired from multicell module tests has been utilized to design the 28-V fuel cell power system. Author

N64-32242 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SELF-CONTAINED CONTROL SYSTEMS OF BALLISTIC MISSILES
A. I. Gordeyev 5 Aug. 1964 80 p refs Transl. into ENGLISH of the pamphlet "Autonomnyye Sistemy Upravleniya Ballisticheskikh Raket" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1964 p 1–79
(FTD-MT-64-300; AD-603324)

General principles are discussed concerning self-contained control systems of ballistic missiles. Tasks for such systems to execute are defined. The operation and design of basic components of these systems are described. Structural diagrams are given of the following: angular stabilization of a rocket about its center of masses; stabilization of said center relative to programed trajectory; and range control of firing and correction of motion of the missile's nose cone. A.W.

N64-32278 Frankford Arsenal, Philadelphia, Pa.
PROPELLANT-ACTUATED DEVICES Progress Report, Jan.–Feb. 1964
[1964] 79 p ref
(Rept.-92-1; AD-442739)

A series of brief reports are presented that describe the progress of certain development programs relating to propellant-actuated devices. The work covered includes the design and development of specific devices, such as thrusters, catapults, and initiators; investigations of related subjects, such as propellants and structural materials; and feasibility studies, aimed at improving the performance of propellant-actuated devices and extending their application. D.E.W.

N64-32285 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
APPLICATION OF SELF-ADAPTIVE CONTROL TECHNIQUES TO THE FLEXIBLE SUPERSONIC TRANSPORT Second Quarterly Technical Report
D. C. Clark, C. B. Notess, F. E. Pritchard, and P. A. Reynolds Nov. 1963 89 p refs
(Contract AF 33(657)-8540)
(CAL-IH-1696-F-2)

This report covers preliminary design of the linear portion of the two adaptive loops. Both accelerometer and rate gyro feedback are considered. A complete high-gain adaptive control system for longitudinal motions has been designed and is presently being examined on an analog computer. The system limit cycle has been set at 1 cps, the prefilter model frequency is 0.4 cps, and the first bending mode frequency (frequency for gyro blender operation) is 1.7 cps. A model-reference adaptive control system is in the design process. Root locus techniques are being used. The passenger comfort criteria have been amplified to cover various combinations of acceleration intensity and probability of occurrence. The effects of nonsteady aerodynamics on the open-loop aircraft transient response were examined briefly. Author

N64-32323 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
APPLICATION OF SELF-ADAPTIVE CONTROL TECHNIQUES TO THE FLEXIBLE SUPERSONIC TRANSPORT Third Quarterly Technical Report
D. C. Clark, R. F. Gavin, F. E. Pritchard, P. A. Reynolds, and J. M. Schuler 1 Apr. 1963 137 p refs
(Contract AF 33(657)-8540)
(CAL-IH-1696-F-3)

This study concerns the applications of high-gain and model-reference adaptive techniques to the supersonic transport control system. These techniques are to be evaluated with the aid of performance criteria, also to be generated from the study, in the areas of passenger comfort, structural fatigue, and handling qualities. The report covers primarily the design of the two types of adaptive systems for control of the longitudinal motions of the assumed supersonic transport, and their evaluation in terms of handling qualities. In addition, a summary is given of the control system performance criteria generated in this study. Also, two preliminary designs for a conventional control system using "programed" gains are presented for comparison with, and to help evaluate, the adaptive systems. The supersonic transport has been described by equations of motion in 5 rigid-body degrees of freedom (constant speed) and 10 structural degrees of freedom. The equations for the two longitudinal rigid-body and four symmetric structural degrees of freedom were linearized and used in the design of the longitudinal control systems. Author

N64-32327 Portugal Nuclear Energy Commission, Sacavem Lab. de Fisica e Engenharia Nucleares
A THEORETICAL STUDY OF AN AUTOMATIC PILOT SYSTEM OF "ALL OR NOTHING" FOR A NUCLEAR REACTOR [ETUDE THEORIQUE D'UN SYSTEME DE PILOTAGE AUTOMATIQUE PAR "TOUT OU RIEN" POUR UN REACTEUR NUCLEAIRE]
J. Menezes (Comm. a l'Energie Atomique Saclay) and P. Jover 18 Apr. 1964 29 p refs In FRENCH; ENGLISH summary
(LFEN-18 (β); CEA-2547)

The automatic control system designed for a high-flux nuclear reactor is of the "constant-speed dead-zone" type, in which the control rod is run at normal speed in the required direction when the error signal overrides a preset level. The study of the closed loop absolute stability was carried out with the describing function method. An analog computer study

yielded the optimal values of the setting parameters (relay hysteresis, motor response time), which lead to a minimization of the control steps frequency when the reactivity varies slowly with the xenon poisoning. Author

N64-32358 Sundstrand Aviation-Denver, Denver, Colo. Marine System Development Dept.
15-KW SOLAR MECHANICAL ENGINE Quarterly Progress Report No. 13, 1 Dec. 1963–29 Feb. 1964
C. N. Hall 15 Mar. 1964 85 p refs
(Contract AF 33(616)-7128)
(CDRD-64-5039; AD-447967)

Activity in this period was directed toward development of the energy-collection subsystem (mirror, heat receiver, and orientation system) and the special test equipment required to prove the feasibility of the subsystem. Tests indicated that more development is needed in several areas to make the dual-cavity receiver operate as desired. A.W.

N64-32365 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio New Product Research Dept.
HIGH TEMPERATURE SOLAR THERMIONIC GENERATORS Quarterly Technical Progress Report, 1 Feb.–30 Apr. 1964
15 May 1964 9 p
(Contract AF 33(657)-11169)
(QTPR-4; AD-441311)

The continuous operation of Converter No. 302 for 3086 hours without performance degradation was accomplished. The design goal of 2160 hours therefore was exceeded. The continuous and cyclic evaluations of the Series 310 converter continued and, to date, 1202 hours of continuous operation have been recorded for Converter No. 312. Converter Nos. 311 and 313 are being cycle-life evaluated, and 1228 cycles toward the 3-month goal (1440 cycles) have been recorded. Author

N64-32391 Directorate of Aerospace Safety, Norton AFB, Calif. Missile Safety Div.
MISSILE VAPOR DETECTION SYSTEMS
[1963] 42 p refs *Its* Study No. 39–63
(AD-420350)

This study describes the physical methods now used with ballistic missile systems to detect hazardous vapors, the limitations of these methods as spill and leak detectors, and future developments in the field of automatic detection of spills and leaks. Emphasis is placed on the safety objectives of spill and leak detection systems. Author

N64-32509 AiResearch Mfg. Co., Los Angeles, Calif.
SNAP-50/SPUR BOILER AND CONDENSER PRESSURE DROP EQUATIONS
P. J. Berenson and A. M. Shah 9 Feb. 1964 28 p refs
(Contract AF 33(657)-10922)
(L-9389; AD-449211)

Sources of pressure drop in the SNAP-50/SPUR boiler and condenser system are analyzed. The development, comparison, and selection of pressure-drop equations used to describe each source of pressure drop are presented. The specific equations used in the boiler and condenser computer program are given. M.P.G.

N64-32560 Thermo Electron Engineering Corp., Waltham, Mass.
THERMIONIC CONVERTER LIFE AND REPEATABILITY INVESTIGATION Third Quarterly Progress Report, 1 Jul.–30 Sep. 1964
C. Z. Kamien [1964] 27 p
(Contract AF 33(615)-1348)
(TE-28-65; AD-449503)

Efforts included the final assembly of four life-test setups. These life-test setups are especially suited for the testing of any converter for long-sustained life as well as for cyclic life evaluation. The life-test setups are also equipped with diagnostic facilities for gas sampling. A unique technique has been developed for the analysis of the minute quantities of gases that evolve in a converter. The diagnostic apparatus has been successfully calibrated. Converter 401-P-2 has been installed in one of the life-test setups, and preparations for life testing of the converter have been completed. Gas sampling preparations of Converter 402-R-2 have been completed, as well as the scanner for the scanning of the first emitter. Author

N64-32576 Sundstrand Aviation-Denver, Denver, Colo.
15-KW SOLAR MECHANICAL ENGINE Quarterly Progress Report No. 14, 1 Mar.–31 May 1964
12 Jun. 1964 105 p ref
(Contract AF 33(616)-7128)
(CDRD-64-5044; AD-449233)

Progress on the research and development plan for a 15-kW solar dynamic power system is discussed. In particular, work directed toward the energy collection subsystem is outlined. The energy collection system consists of a 44.5-ft-diam parabolic mirror, a cavity heat receiver that absorbs the reflected solar energy, and an orientation system to maintain the correct alignment of the system with the sun. Full-scale mirror fabrication was completed. The full-scale heat receiver was redesigned to use biphenyl as the working fluid. Fabrication of breadboard orientation system components is approximately 70% complete. P.V.E.

N64-32597 Frankford Arsenal, Philadelphia, Pa.
PROPELLANT ACTUATED DEVICES Progress Report, May-Jun. 1964
[1964] 92 p refs
(PAD-94-1; AD-449223)

This report describes the progress of certain development programs relating to propellant actuated devices (PAD). The work covered includes the design and development of specific devices, such as thrusters, catapults, and initiators; investigations of related subjects, such as propellants and structural materials; and feasibility studies, aimed at improving the performance of propellant actuated devices and extending their application. Author

N64-32601 Franklin Inst., Philadelphia, Pa. Research and Development Labs.
CATALYTIC COMBUSTION HEAT SOURCES FOR THERMAL ENERGY CONVERTERS Third Quarterly Progress Report, 1 Oct. 1963–15 Feb. 1964
Mullapudi M. Reddi and Robert A. Baker [1964] 18 p
(Contract DA-039-AMC-01277(E))
(Rept.-3; Q-B2088-3; AD-448761)

Investigations leading to the development of a catalytic burner using leaded gasoline as a fuel use with thermoelectric generators are reported. Detailed parametric studies on a vanadia catalyst are given. Results of an experimental design were analyzed by a multivariate regression model, and expressions for percent oxidation and maximum temperature are given in terms of air and gasoline flow rates. Effects of catalytic element geometry on burner heat transfer are discussed, and details of an element configuration are given, along with design details of an experimental thermoelectric generator. Author

N64-32604 Gulton Industries, Inc., Metuchen, N.J. Alkaline Battery Div.
DESIGN, FABRICATION, AND TESTING OF SEALED, RECHARGEABLE SILVER-CADMIUM CELLS Third Quarterly Progress Report, 1 Jan.–31 Mar. 1964
G. M. Apgar and D. Burdett [1964] 19 p
(Contract DA-36-039-AMC-03358(E))
(Rept.-3; AD-449231)

The capabilities of vent design and effective discharge rates of sealed, rechargeable silver–cadmium cells are discussed. It was found that Teflon internal seals could not be vented and closed within the allowable tolerance of ±25% nominal release pressure set at 75 psig, and neoprene O-rings were substituted. A high discharge rate of 14 amperes on a cell subassembly, consisting of terminal, comb, and the portion of the plates welded to the comb, resulted in a high IR drop and high terminal temperatures due to high resistance of both the tab and the terminal. A limiting discharge rate is recommended. G.G.

N64-32605 Radio Corp. of America, Lancaster, Pa. Special Electronic Components Div.
THE DEVELOPMENT OF A THERMIONIC CONVERTER MODULE SUITABLE FOR LIQUID METAL HEATING Quarterly Technical Report, 15 Jun.–15 Sep. 1963
G. Y. Eastman and J. J. O'Grady Oct. 1963 23 p
(Contract AF 33(657)-8005)
(QTR-7; AD-420017)

The overall concept of the 3-V generator has been established. Before final design and fabrication of the generator, the more difficult problems are being solved by fabricating and testing prototype 3-converter modules. Four 3-converter modules were assembled. A number of subassemblies were successfully tested, and techniques for assembling a series of converters within a single envelope were perfected. A method of bonding the center heat source tubing has been tentatively selected, and materials for detailed evaluation of the method have been ordered. Life testing of one Type A-1198B converter was concluded after 1010 hours. Another converter of this type has since completed 600 hours of a life test with a constant output of 46 W. Author

N64-32646 Army Material Command, Washington, D.C.
PROPELLANT ACTUATED DEVICES Engineering Design Handbook
30 Aug. 1963 172 p refs
(AMCP-706-270; AD-449769)

The handbook includes a description of propellant-actuated devices; conceptual, preliminary, and ballistic designs; design examples; and ballistic and performance evaluation. E.C.

N64-32685 Harshaw Chemical Co., Cleveland, Ohio Solid-State Research Lab.
LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION Third Quarterly Technical Progress Report, 15 Mar.–15 Jun. 1963
J. C. Scaefer, R. J. Humrick, and E. R. Hill 21 Jun. 1963 32 p refs
(Contract AF 33(657)-9975)
(QTPR-3; AD-407525)

A 5.1% thin-film cell has been produced on a 1 × 1 in. substrate. This result compares favorably with the maximum efficiency of 5.4% reported for a single-crystal CdS cell. A procedure for upgrading low-efficiency cells to the average efficiency level has also been developed. A nondestructive X-ray technique has been used successfully to photograph dislocations in single-crystal CdS. Efforts to produce an ultrapure CdS by distillation of the elements and subsequent reaction is underway. Work has been carried on in the analysis of the I-V data and spectral response in an effort to catalog these data in the form of a model. The present data can be made to fit a p-n junction with photoconductive series and shunt resistances. Author

N64-32689* Pratt and Whitney Aircraft, East Hartford Conn.
SPACE POWERPLANT STARTUP AND TRANSIENT OPERATION SIMULATION WITH DIRECT-CONDENSING RADIATOR SYSTEM Topical Report, Jun. 1–Dec. 1, 1963
J. R. Hooper and H. R. Kunz 6 May 1964 60 p ref
(Contract NAS3-2335)
(NASA-CR-54179; PWN-2342) OTS: $3.00 fs; $0.75 mf

Tests concluded investigations on a two-loop powerplant configuration. The principal problem in starting a two-loop powerplant with the hard-fill technique is to maintain the NPSH requirements at the power-loop inlet. Testing on the simulator indicated that in a powerplant in which the steady state pump inlet pressure is designed to provide a reasonably small NPSH margin, the pump would cavitate during a standard hard-fill start. Modifications may be made in the hard-fill procedure to control the radiator temperature so as to assure an adequate pump inlet pressure during the starting period. The simplest modification that would make the hard-fill starting method workable seems to be an overfilling from the fill tank during the starting period. Possible problems in the operations of the power loop without an accumulator are these: (1) possibility of injecting an incorrect amount of fluid during starting; (2) leaks that may occur in the system; and (3) operating characteristics of some components that may change with time. E.C.

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-31349 Temple U., Philadelphia, Pa. Research Inst.
PRODUCTION, ISOLATION AND IDENTIFICATION OF MONO-OXYFLUORINE, DI-OXYFLUORINE AND TRIOXYFLUORINE RADICALS Quarterly Progress Report, Apr. 1–Jun. 30, 1964
A. V. Grosse and A. D. Kirshenbaum [1964] 17 p refs
(Contracts AF 04(611)-9555; Nonr-3085(01))
(QPR-3; AD-603226) OTS: $1.00

Work on the production, isolation, and identification of the $OF_\cdot$, $O_2F_\cdot$, and $O_3F_\cdot$ radicals is reported. The electron paramagnetic-resonance spectrum of O_4F_2 was obtained and studied. It showed O_4F_2 to be almost 100% paramagnetic and its spectrum to be different from that obtained from O_2F_2 and O_3F_2. The study of the . . . O_2F radical is being continued. The EPR spectrum of O_2BF_4 in anhydrous HF was obtained and studied. Single crystals of O_2F_2 were grown for ^{60}Co gamma-ray irradiation at 77° K. Apparatus for producing $OF_\cdot$ radicals by ultraviolet irradiation of O_3 and F_2 is under construction. D.E.W.

N64-31373 Pennsylvania State U., University Park
THE VIBRATIONAL SPECTRUM, STRUCTURE, AND POTENTIAL CONSTANTS OF NITRIC ACID Scientific Report No. 1

I. C. Hisatsune 31 Jul. 1964 70 p refs
(Contract AF 19(604)-7987)
(AFCRL-64-651; AD-604884)

The present work completes a vibrational analysis of four isotopic nitric acid molecules including the N-15 and D-species. The infrared spectra have been obtained in both the vapor and solid states. The Raman spectra of anhydrous and wet $HN^{14}O_3$ in the liquid phase were also studied. Three new fundamentals in the solid spectrum have been identified, and two vapor phase fundamentals were reassigned. The spectrum of the solid has been interpreted on the basis of a dimeric model. Hot bands of the torsional mode in the vapor phase were resolved, and from them a barrier to hydrogen internal rotation was calculated to be 7.83 ±0.05 kcal/mole. A summary of all fundamentals and their assignments is given in a table. Force constants were determined that adequately describe the spectra and verify the new assignments. Author

N64-31404 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NONFERROUS METALLURGY
30 Jun. 1964 240 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Tsvet. Met. (Orodzhonikidze), no. 3, 1963 p 1–166
(FTD-MT-64-14; AD-603663)

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9. STUDY OF THE INFLUENCE OF CERTAIN REAGENTS ON THE FLOTATION PROPERTIES OF THE MINERALS OF CARBONATITE ROCKS D. I. Kogan and V. A. Rychagov p 65–74 refs (See N64-31409 23-07)

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17. THE EFFECT OF ULTRASOUND ON THE PROCESS OF LEACHING DIFFICULTY-SOLUBLE RARE METAL COMPOUNDS N. N. Khavskiy, I. A. Yakubovich, B. A. Agranat, O. D. Kirillov, and P. V. Vasil'yev p 144–152 refs (See N64-31417 23-07)

18. THE BEHAVIOR OF THE BASIC CONSTITUENT BLAST-FURNACE SLAG COMPONENTS DURING HYDROCHEMICAL PROCESSING A. R. Rakhimov, V. D. Ponomarev, and L. P. Ni p 153–160 refs (See N64-31418 23-07)

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22. FORCE CONDITIONS DURING PRESSING OF PIPES WITH ARBITRARY INTERNAL RELIEF M. F. Zakharov, Yu. P. Glebov, and M. Z. Yermanok p 180–191 refs (See N64-31422 23-17)

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SCIENTIFIC CHRONICLE

27. SHORT INFORMATION ON SESSION OF SCIENTIFIC SEMINAR ON MINING THERMOTECHNICS OF THE Ac Sc UkSSR T. S. Guriev p 230–232

N64-31405 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
USE OF ELECTRON MICROSCOPY IN STUDYING THE REACTION OF REAGENTS WITH INEVITABLE PULP IONS AND MINERAL SURFACES

S. I. Pol'kin, A. M. Komelev, and Ye. P. Petukhov *In its* Nonferrous Met. 30 Jun. 1964 p 32–42 refs (See N64-31404 23-07)

Electron microscopy was used for studying the interaction of sodium oleate with inevitable pulp ions, as well as the surfaces of certain minerals. Flotation reagents can react either simultaneously or selectively, first with the pulp cations and anions, and then with the mineral surfaces. The structure and a number of the physicochemical properties of the products of these reactions are explained. A.W.

N64-31406 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATION OF THE MECHANISM OF THE REACTION OF THE CATION COLLECTOR AND WITH APATITE AND CALCITE BY RADIOMETRY AND INFRARED SPECTROSCOPY

S. F. Kuz'kin, V. I. Solnyshkin, and Chen Yu-Lung *In its* Nonferrous Met. 30 Jun. 1964 p 43–49 refs (See N64-31404 23-07)

The spectrum of the cation collector ANP, which is a mixture of primary amines and amino acids in hydrochloride form, was photographed by infrared spectroscopy. Physical adsorption of ANP in the form of molecules and ions of amines and amino acids occurs in the diffusion layer on the surface of apatite. The diffusion layer formed by ANP on the surface of calcite consists of complex compounds of amines and amino acids with carbonic acid; ANP is also chemosorbed in the form of complex salts of the amino groups. These infrared spectra and radiometry show that the cations of the primary amines and amino acids exhibit activity during the flotation of apatite and calcite with ANP, forming polymolecular layers in the diffusion layer by hydrogen bonding. Author

N64-31407 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STATE OF THE DOUBLE ELECTRIC LAYER OF TANTALITE AND CERTAIN CONCOMITANT MINERALS DURING FLOTATION

T. B. Mayfonov, S. I. Pol'kin, and R. Sh. Shafeyev *In its* Nonferrous Met. 30 Jun. 1964 p 50–58 refs (See N64-31404 23-07)

Tantalite, tourmaline, and garnet are floated well by oleic acid at pH's of 6 to 8, where the surfaces have their maximum electrokinetic index during adsorption of the collector on the minerals. The increase in the negative ξ-potential in the presence of oleic acid makes it possible to assume that the latter is fixed by chemosorption on the surfaces of the minerals investigated. From the change in the capacitance of the double electric layer the null-charge point in distilled water at various concentrations of HCL and KOH is determined, and the adsorption potential of oleic acid on tantalite surfaces is calculated. Author

N64-31408 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NAPTHAZOLETHIONES AS POTENTIAL COLLECTORS FOR OXIDE AND SULFIDE MINERALS OF LEAD AND COPPER

G. N. Tyurenkov and I. A. Kakovskiy *In its* Nonferrous Met. 30 Jun. 1964 p 59–64 refs (See N64-31404 23-07)

The conclusion is reached that naphthazolethiones are more effective collectors than benzazolethiones in the flotation of the sulfide ore and oxide ore of nonferrous metals. The reagent considered best is napth-/2,1/-thiazole-2-thione (commercially called "naphthax"). It is decided that it is especially desirable to use naphthax in the flotation of copper and lead oxide ores without preliminary sulfidization, and in the flotation of precious metal ores. A.W.

N64-31409 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STUDY OF THE INFLUENCE OF CERTAIN REAGENTS ON THE FLOTATION PROPERTIES OF THE MINERALS OF CARBONATITE ROCKS

D. I. Kogan and V. A. Rychagov *In its* Nonferrous Met. 30 Jun. 1964 p 65–74 refs (See N64-31404 23-07)

The surfaces of the minerals studied carry a negative charge; pyrochlore II has a larger negative charge than pyrochlore I, and this to some extent determines the difference in their flotation properties. Hydrogen and hydroxyl ions regulate the potential for this group of minerals. Small concentrations of sodium silicate sharply reduce the electrokinetic potential of pyrochlore. The selective depressive action of sodium sulfide on pyrochlore and magnetite at pH 8 to 11 is apparently manifested in the sorption of sulfhydryl and hydroxyl ions and hydrogen sulfide molecules on their surfaces. Preliminary treatment of mineral surfaces with hydrofluoric and hydrochloric acids probably promotes the removal of foreign impurities. Calcium and ferric ions are actively sorbed on mineral surfaces; it is possible that the presence of low concentrations of these ions leads to completion of the crystal lattices of the minerals. Author

N64-31410 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATION OF THE KINETICS OF THE REACTION OF CARBON WITH OXYGEN DISSOLVED IN COPPER AND TIN

P. M. Shurygin and V. I. Kryuk *In its* Nonferrous Met. 30 Jun. 1964 p 75–81 refs (See N64-31404 23-07)

The use of equal available surfaces on revolving disks was employed to investigate the kinetics of the reaction of carbon with oxygen dissolved in copper and tin. It was found that the process rate is limited by the diffusion of the oxygen in the metal. The coefficients of oxygen diffusion in copper and tin and their temperature functions were experimentally determined. The order of D for copper was 10^{-5} cm^2/sec, while that for tin was 10^{-6} cm^2/sec; the activation energy of diffusion in tin and copper was 82 000 and 35 000 joules/mole, respectively. It was shown that poling and deoxidation should be accelerated by increasing the reaction surface and intensifying agitation. Author

N64-31411 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THERMODYNAMIC PROPERTIES OF MOLTEN LEAD SILICATES

V. I. Minenko and N. S. Ivanova *In its* Nonferrous Met. 30 Jun. 1964 p 82–89 refs (See N64-31404 23-07)

The emf of the chemical chains $Pb[\chi PbO + (1 - \chi)SiO_2]$ $O_2(P_{O_2} = 1$ atm), Pt was measured at temperatures of 800°, 900°, 940°, 1000°, 1100°, and 1200°C within the range of concentrations in which the system $PbO \cdot SiO_2$ is homogeneous. Using the results of these measurements as a basis, the following were calculated: the isobaric-isothermal potentials of lead oxide formation in melts of PbO and mixtures of PbO and SiO_2; the change in the isobaric-isothermal potential, enthalpy, and entropy during the transfer of one mole of lead oxide from a pure oxide melt and one mole of silicon dioxide from a melt saturated with silica into a melt of a given concentration; and the integral values of the isobaric-isothermal potential, enthalpy, and entropy of the formation of melts from molten lead oxide and tridymite. Author

N64-31412 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

REDUCIBILITY OF LEAD AGGLOMERATES

A. Ye. Guriyev and M. B. Tsalikova *In its* Nonferrous Met. 30 Jun. 1964 p 90–99 refs (See N64-31404 23-07)

The behavior of ferric oxides was studied under the conditions that exist during the agglomeration of lead. It was established that part of the iron, which changes to magnetite during agglomeration, can be reduced to a greater or lesser extent than the initial hematite. A study was made of the influence of temperature on the rate at which lead agglomerates are reduced by hydrogen and carbon monoxide. The porosity of the agglomerates significantly affected their reduction rate. A.W.

N64-31413 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE ROLE OF ANTIMONY DURING THE EXTRACTION OF BISMUTH

P. I. Fedorov and V. I. Shachnev *In its* Nonferrous Met. 30 Jun. 1964 p 100–111 refs (See N64-31404 23-07)

The common solubility of calcium and magnesium antimonides in molten lead at 400° C was established by the method of isothermal analysis. The existence of the $CaMg_2Sb_2$ ternary compound with a congruent solubility of 0.092% for antimony was determined. The common solubility of Mg_3Sb_2 in lead and of Mg_3Bi_2 and Mg_3Sb_2 in bismuth lead was investigated. The existence of solid solutions Mg_3Sb_2—Mg_3Bi_2 was established. The study of the common solubility of Ca_3Sb_2 and Ca_3Bi_2, and also of $CaMg_3Sb_2$ and $CaMg_2Bi_2$ showed the existence of continuous solid solutions among these pairs of compounds. The lead angle isotherms at 400° C of the Pb—Bi—Mg—Sb and Pb—Bi—Ca—Sb systems, and of the quaternary reciprocal of Ca_3Sb_2, Ca_3Bi_2, Mg_3Sb_2, Mg_3Bi_2 and Pb were plotted in semiquantitative form. A theory on the role of antimony in the process of fine bismuth extraction from lead is offered. Author

N64-31414 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BEHAVIOR OF ARSENIC IN THE PROCESS OF LEACHING ZINC CINDERS IN A SULFURIC ACID SOLUTION

R. G. Ageyenkov and Z. A. Serikov *In its* Nonferrous Met. 30 Jun. 1964 p 112–128 refs (See N64-31404 23-07)

Arsenic produced during zinc leaching is obtained in the acid and not in the neutral branch; it does not form by adsorption but occurs in the form of chemical compounds that are insoluble in dilute sulfuric acid. The process of adsorption is only a subsidiary process of deep purification of the neutral zinc solution from relatively small amounts of arsenic. The mechanism of the formation of iron arsenate manganese is outlined. Author

N64-31415 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE QUESTION OF SELECTING ADDITIVES FOR THE IMPROVEMENT OF THE COMPOSITION OF THE ALUMINUM BATH ELECTROLYTE

S. V. Tararin and A. I. Beyayev *In its* Nonferrous Met. 30 Jun. 1964 p 129–134 refs (See N64-31404 23-07)

In selecting additives for aluminum bath electrolytes in order to introduce magnesium and chlorine ions, the cost of materials should be the yardstick, inasmuch as the physicochemical properties of the melts with any of the MgO + NaCl, MgF_2 + NaCl, or $MgCl_2$ additives are analogous if the composition of the electrolyte is the same. According to the results of industrial tests of electrolytes with additives that contain magnesium and chlorine ions, an adjusting mixture with 77% NaCl and 23% MgO in quantities of 11 to 13 kg/t Al is recommended. Author

N64-31416 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE QUESTION OF THE INTENSIFICATION OF CYANIDATION OF GOLD-BEARING ORES

S. B. Leonov and M. F. Khabrov *In its* Nonferrous Met. 30 Jun. 1964 p 135–143 refs (See N64-31404 23-07)

The application of a sand pump installation with a hydrocyclone shows the possibility of a substantial reduction of the cyanidation time for gold-bearing ores (six to eight times). It was established that approximately half of the total amount of metal was dissolved during the passage of the pulp through the hydrocyclone and the same amount during its passage through the pump. Author

N64-31417 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF ULTRASOUND ON THE PROCESS OF LEACHING DIFFICULTY-SOLUBLE RARE METAL COMPOUNDS

N. N. Khavskiy, I. A. Yakubovich, B. A. Agranat, O. D. Kirillov, and P. V. Vasil'yev *In its* Nonferrous Met. 30 Jun. 1964 p 144–152 refs (See N64-31404 23-07)

It was found that an ultrasonic field created by a magnetostrictive transformer with a frequency of 18 to 20 kc and an ultrasound intensity of 0.55 wt/cm^2 appreciably accelerates the dissolution of these compounds in soda solutions. The ultrasonic effect proved most conspicuous with a slower mechanical mixing. Ultrasound application prevents diffusion and capillary limitations, enhancing the dissolution substances. Author

N64-31418 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE BEHAVIOR OF THE BASIC CONSTITUENT BLAST-FURNACE SLAG COMPONENTS DURING HYDROCHEMICAL PROCESSING

A. R. Rakhimov, V. D. Ponomarev, and L. P. Ni *In its* Nonferrous Met. 30 Jun. 1964 p 153–160 refs (See N64-31404 23-07)

The behavior of the main alumina blast-furnace slag constituents, such as anorthite, galena, and its eutectic mixture calcium dialuminate was studied during leaching by hydrochemical methods. The possibility of decomposing the main constituent components of blast-furnace alumina slag by hydrochemical methods was shown for the first time. The most suitable components for hydrochemical alkaline processing were found to be galena and galena–dialuminate high-alumina blast-furnace slags. Author

N64-31419 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SEPARATION OF VANADIUM AND URANIUM IN FLUORIDE SOLUTIONS WITH THE HELP OF ANIONITES

V. S. Pakholkov and A. Ya. Korbut *In its* Nonferrous Met. 30 Jun. 1964 p 161–169 refs (See N64-31404 23-07)

The sorption of uranium (VI) from HCl–HF solutions was investigated, and the results of the study were compared with results of vanadium sorption to determine the conditions of separation of these two elements. The removal of vanadium (IV), sorbed from HCl–HF solutions and from AB-17, EDE-10P, AB-16, and AH-2F anionites in H_2–HF and HCl–HF solutions was also investigated. A method of uranium (VI) and vanadium (V) separation in solutions, containing hydrofluoric acid and anionites has been proposed and experimentally verified. Author

N64-31572 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 110
28 Sep. 1964 81 p refs Transl. into ENGLISH from Hua Hsueh Tung Pao (Peiping), no. 6, Jun. 1964 p 9–16, 22–31, 54–56
(JPRS-26583; TT-64-41841) OTS: $3.00

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2. AROMATIC POLYFLUORO COMPOUNDS Wang Chih-ch'in p 31–64 refs (See N64-31574 23-07)
3. STRUCTURES OF CYCLOBUTADIENE Liang Hsiao-t'ien p 65–68 refs (See N64-31575 23-07)
4. PAPER ELECTROCHROMATOGRAPHIC SEPARATION OF MOLYBDENUM AND RHENIUM Yin po-hai p 69–75 ref (See N64-31576 23-07)
5. PUBLICATION OF PATHOLOGICAL ANATOMY OF THE EYE—A FIRST IN CHINA p 76
6. GREAT ACHIEVEMENTS IN RESEARCH AND APPLICATION OF ULTRASONIC DIAGNOSTICS IN CHINA p 77–78

N64-31573 Joint Publications Research Service, Washington, D.C.
ELECTROLYTIC INITIATION OF OLEFINIC POLYMERIZATIONS
Wu Chin-yuan and Hu Chen-ya *In its* Transl. on Communist China's Sci. and Technol., No. 110 28 Sep. 1964 p 1–29 refs (See N64-31572 23-07) OTS: $3.00

The characteristic of the electrolytically initiated polymerization is that the initiation centers are formed by electrode reactions. Therefore, in suitable reaction systems and reaction conditions the induction period does not exist in the initiation process, the reaction may be carried out at low temperature, and control of electric current density can regulate, to a certain extent, the rate and degree of polymerization of the polymer. Polymerizations of low aliphatic halogen-substituted olefines and other monomers of low boiling point are of particular interest. Author

N64-31574 Joint Publications Research Service, Washington, D.C.
AROMATIC POLYFLUORO COMPOUNDS
Wang Chih-ch'in *In its* Transl. on Communist China's Sci. and Technol., No. 110 28 Sep. 1964 p 31–64 refs (See N64-31572 23-07) OTS: $3.00

Perfluorobenzene is the most basic of all aromatic fluorine compounds, and a series of derivatives may be synthesized from it. Methods of preparation of perfluorobenzene are divided into two groups: (1) thermal decomposition and polymerization of aliphatic fluorine compounds; and (2) aromization of polyfluorocyclohexane. A.W.

N64-31575 Joint Publications Research Service, Washington, D.C.
STRUCTURES OF CYCLOBUTADIENE
Liang Hsiao-t'ien *In its* Transl. on Communist China's Sci. and Technol., No. 110 28 Sep. 1964 p 65–68 refs (See N64-31572 23-07) OTS: $3.00

The possible structures of cyclobutadiene are considered. Since free cyclobutadiene is extremely unstable and polymerizes instantly, it must be stored in the form of a complex salt. Cyclopropylene and some other compounds of high tension are relatively stable. The high activity of cyclobutadiene cannot be explained by tension alone. The paper reports other possibilities, among which are inversion between the tuplet and singlet state and the distribution of the two electrons of the alkyl radical among the orbitals of the silver ion and the two carbon atoms. A.W.

N64-31576 Joint Publications Research Service, Washington, D.C.
PAPER ELECTROCHROMATOGRAPHIC SEPARATION OF MOLYBDENUM AND RHENIUM
Yin Po-hai *In its* Transl. on Communist China's Sci. and Technol., no. 10 28 Sep. 1964 p 69–75 ref (See N64-31572 23-07) OTS: $3.00

Molybdenum and rhenium may be separated in the medium of 0.01–0.50 N hydrochloric acid with New China filter paper as a supporter in electrophoresis conducted at 13 V/mm for 10 min. Ten percent potassium thiocyanate solution and five percent stannous chloride solution are used as developers. The spots obtained are unique, with clear edges. Traces of rhenium may be separated from a large quantity of molybdenum. Author

N64-31638 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A METHOD OF OBTAINING HYPERSENSITIZED PHOTOGRAPHIC EMULSIONS
S. M. Solov'yev and N. M. Parfenova 10 Feb. 1964 3 p Transl. into ENGLISH from Russian Patent No. 118405 (Appl. No. 367802), 26 Mar. 1949 p 1
(FTD-TT-63-1006/1+4; AD-433246)

The drawback in hypersensitized photographic emulsions of extremely poor stability, characterized by an intense growth of fog, is reduced by using 5-methyl-7-oxy-1,3,4-triazoindolysine as a stabilizer. R.L.K.

N64-31658 Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Inst. for Research
NICKEL-TUNGSTEN ELECTROLESS DEPOSITION
Fred Pearlstein, Robert Weightman, and Reyburn Wick 15 Sep. 1964 5 p refs
(A-63-23; SEG-TDR-64-35; AD-447694)

A solution was developed for co-depositing nickel and tungsten from a hypophosphite-based electroless plating solution. Deposits containing over 18% tungsten were produced from a solution containing the following:

$NiSO_4 \cdot 6H_2O$, 7 g/l;
$Na_2WO_4 \cdot 2H_2O$, 35 g/l;
$Na_3C_6H_5O_7 \cdot 2H_2O$, 40 g/l;
and $NaH_2PO_2 \cdot H_2O$, 10 g/l.

Author

N64-31698 Notre Dame U., Ind. Physical Electronics Research Group
THE DESORPTION AND MIGRATION OF STRONTIUM ON TUNGSTEN USING PULSED FIELD EMISSION MICROSCOPY
T. Madey, A. Petrauskas, and E. Coomes [1963] 52 p refs (Contract Nonr-1623(01))
(AD-421552)

Pulsed field-emission microscope techniques were used to obtain quantitative data about the kinetics of strontium and tungsten. The activation energies for desorption of strontium from wolfram as a function of strontium coverage, as well as for surface migration of a strontium deposition on wolfram less than an atomic layer, were determined. Also, the kinetics of the boundary migration of heavy coverages of strontium on

wolfram were examined, particularly in the lower Miller-index regions of the wolfram substrate. G.G.

N64-31707 Aeronautical Systems Div., Wright-Patterson AFB, Ohio AF Materials Lab.
X-RAY CRYSTALLOGRAPHIC AND POWER DATA FOR SOME GROUP IV A AND V A PHENYL COMPOUNDS Technical Documentary Report, Aug. 1962–May 1963
David W. Fischer Aug. 1963 41 p refs
(ASD-TDR-63-673; AD-420363)

Results are shown for X-ray crystallographic and/or X-ray powder diffraction analysis of 44 phenyl compounds of groups IV A and V A. Crystallographic data includes lattice parameters, space groups, molecules per cell, density, and the indexed powder patterns. Author

N64-31710 Notre Dame U., Ind.
SYNTHESIS AND EVALUATION OF POLYMERS WITH SPECIAL PROPERTIES
G. F. D'Alelio and R. C. Evers 15 Apr. 1963 10 p
(Contract DA-11-022-AMC-169(A))
(QR-1; AD-422299)

Small amounts of 1-acryloxy-2-butyne and 1-methacryloxy-2-butyne were prepared to demonstrate that a monomer containing both an ethynyl and a vinyl linkage flanked by an electron withdrawing group could be polymerized through the vinyl group into a linear polymer containing unreacted pendent acetylene moieties. The required intermediate 2-butyn-1-o1 was prepared from 1,3-dichloro-2-butene by a two-step process and converted to the desired monomeric esters. These esters were polymerized using cationic and radical initiators, and in both cases, insoluble, infusible polymers were obtained. The same monomers were polymerized to the desired soluble, linear polymers with anionic initiators resulting in the disappearance of the vinyl grouping and a retention of the acetylenic grouping. This was confirmed by infrared spectra. The reactivity of the pendent triple bond was demonstrated by bromine addition and by benzoyl peroxide-catalyzed cross linking. D.E.W.

N64-31815 RAND Corp., Santa Monica, Calif.
MASS ACTION LAWS AND THE GIBBS FREE ENERGY FUNCTION
N. Z. Shapiro and L. S. Shapley Sep. 1964 59 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3935-1-PR; AD-605919)

The relationship between the mass action laws and the Gibbs' free-energy function is investigated with respect to several attendant mathematical questions. The questions involve the following: the existence and uniqueness of a solution to the equations arising from the mass action laws; the existence and uniqueness of a composition that minimizes the free energy; and the precise relationship between the two. In the first part of the paper, the mathematical questions are formulated from a mathematical and chemical viewpoint. In the second section, mathematical tools unavailable in Gibbs' time are employed in an attempt to answer the questions posed. P.V.E.

N64-31818 RAND Corp., Santa Monica, Calif.
A GENERALIZED TECHNIQUE FOR ELIMINATING SPECIES IN COMPLEX CHEMICAL EQUILIBRIUM CALCULATIONS
N. Z. Shapiro Sep. 1964 31 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4205-PR; AD-605316)

A method was found to replace a multi-phase or single-phase chemical equilibrium problem, with a large number of different chemical species, by one with relatively fewer agents and more accessible to numerical solution. An earlier developed technique, D-2419 by Danzig and DeHaven, is generalized and adapted to more complex systems by quantitative equations. G.G.

N64-31824 United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH OF ASPECTS OF MASS TRANSPORT NEAR THE THREE-PHASE ZONE OF AN OXYGEN ELECTRODE Final Report
H. B. Urbach and D. G. Mc Mahon 30 Jun. 1964 76 p refs
(Contract AF 19(628)-3234)
(AFCRL-64-539; AD-606399)

An idealized experimental and mathematical model based upon a semi-infinite cathode covered with a thin uniform meniscus of electrolyte has been developed for the study of the mechanisms of mass transport of oxygen to the cathode. Employing this model, an experiment designed to detect mass transport by the migration of adsorbed oxygen on the cathode failed to show evidence of a significant migration mechanism. Experimental measurements indicated that effective length-to-thickness ratios of the meniscus are from 3×10^3 to 10×10^3 in magnitude, rather than 2×10^2 as previously reported in the literature. Calculations of the theoretical diffusion transport based upon the new ratios were shown to account for observed electrode performance. The magnitude of the oxygen adsorption rate constant on platinum in caustic media was indirectly measured and found to be approximately 4.9×10^{-5} cm/sec. The oxygen exchange current on platinum was measured and found to have an average value of 3×10^{-5} A/cm^2. The corresponding equilibrium sorption rate and faradaic exchange rate at 1 atm are 1.1×10^{-12} and 7.8×10^{-11} mole/cm^2 sec, respectively. Author

N64-31893 Johnston (W.H.) Labs., Inc., Baltimore, Md.
BASIC STUDIES IN QUANTUM AND RADIATION CHEMISTRY Technical Documentary Report, Dec. 1961–Jun. 1964
Marvin Vestal, M. Krause, and William H. Johnston Wright-Patterson AFB, Ohio, AF Mater. Lab., Jun. 1964 107 p refs
(Contract AF 33(616)-7678)
(ML-TDR-64-169; AD-605457)

The primary interactions of high-energy photons and electrons with matter in the gas phase were studied. The experimental studies included measurements of the mass-charge spectra produced both by X-ray ionization and by high-energy electron ionization, as well as secondary electron energy measurements for both X-ray and electron ionization. These measurements were carried out using a mass spectrometer. The molecules studied were the following: propane, ethanol, ethylamine, silane, hydrogen sulfide, hydrogen chloride, argon, methane, ammonia, water, neon, ethyl silane, ethanethiol, ethyl chloride, methyl chloride, methyl bromide, ethyl bromide, hydrogen bromide, krypton, methyl iodide, ethyl iodide, carbon tetrachloride, xenon, mercury, dimethylamine, 1,3-butadiene, n-butane, 2-butyne, oxygen and nitrogen. Author

N64-31915 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE OXIDATION OF BRANCHED PARAFFINS
P. G. Igonin, V. V. Svitkin et al 10 Jun. 1964 10 p refs
Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 5, 1963 p 34–38
(FTD-MT-64-02; AD-602312)

The oxidation of an alkylated gasoline fraction, "Motoalkilat," resulted in the formation of acids, most of which did not form a complex with urea. These acids are analogous to normal fatty acids, but have lower temperatures of solidification and higher acid numbers. M.P.G.

N64-31920 Westinghouse Electric Corp., Pittsburgh, Pa. Westinghouse Research Labs.
A STUDY OF THE ADSORPTION MECHANISMS ON OXYGEN ELECTRODES Second Semiannual Report, 1 Jan.–31 May 1963
Y. L. Sandler 10 Jun. 1963 32 p refs
(Contract DA-36-039-AMC-00136(E); ARPA Order 226)
(Rept.-2; AD-420242)

Experiments on the adsorption and exchange of oxygen on oxidized palladium and silver are described. When oxidized palladium is cooled from high temperatures at an oxygen pressure corresponding to the composition PdO, a fast exchange reaction $O^{16}{}_2 + O^{18}{}_2 \rightarrow 2\ O^{16}O^{18}$ is observed at room temperature. If cooled in excess oxygen no activity is observed. Similarly, water completely inactivates the surface by displacing the weakly chemisorbed oxygen. Further exchange experiments with a pre-adsorbed oxygen isotope on silver at 200° C are described, using an improved method, which allows determination of the rates of adsorption and exchange as separate processes. Improved methods of evaluation of the results are described. Author

N64-31925 Naval Research Lab., Washington, D.C.
UPPER LIMITS FOR THE CONTACT ANGLES OF LIQUIDS ON SOLIDS
Elaine G. Shafrin and W. A. Zisman 12 Sep. 1963 23 p refs
(NRL-5985; AD-421998)

Earlier systematic studies of the angle of contact (θ) exhibited by drops of liquid on plane solid surfaces of low surface energy have made data available on equilibrium contact angles. These data were obtained under well-controlled and comparable experimental conditions for many liquids on over 100 different solid sufaces. Examination of the data for eight, selected, pure liquids (water, formamide, methylene iodide, hexachloropropylene, t-butylnaphthalene, dicyclohexyl, n-hexadecane, and n-decane) reveals a wide variation in the wetting behavior of any single liquid toward different solid surfaces. For each liquid, however, graphical plots of cosine θ versus the difference in the surface tension (γ_{LV}) of the pure liquid and the critical surface tension of spreading (γ_c) of the solid are found to group available data into a zone bounded by a straight line passing through the origin ($\cos\theta = 1$, $\gamma_{LV} - \gamma_c = 0$). From the parameters defining this straight line, estimates can be made of the limiting contact angles for each liquid. Author

N64-31978 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
QUANTITATIVE DETERMINATION OF DOUBLE BONDS IN UNSATURATED SILICO-ORGANIC COMPOUNDS BY SPECTRAL ABSORPTION IN THE INFRARED REGION
Yu. Ya. Mikhaylenko, L. P. Senetskaya, and Ye. G. Kutyrina 27 Aug. 1964 9 p refs Transl. into ENGLISH from Organ. Analiz., Akad. Nauk SSSR, Tr. Komis. po Analit. Khim. (USSR), v. 13, 1963 p 383–388
(FTD-TT-64-458/1+2; AD-603662)

The use of infrared absorption spectroscopy in the determination of double bonds in unsaturated silico-organic compounds is reported. The bands at 940 to 960 cm^{-1} are used to determine the $CH{=}CH_2$ bonds in the organo-silicates just as in the hydrocarbons. The integral coefficient of absorption is used in the calculations describing the absorbing substance in the nonabsorbing solvent. The actual procedure used to detect divinyl-tetraethoxy-disiloxane and vinyl-triethyoxysilane, both in a solution of carbon disulfide, is described in detail. M.P.G.

N64-31981 Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE PHOTOLYSIS OF PHOSGENE–ETHYLENE MIXTURES
Julian Heicklen 30 Aug. 1964 39 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-154; TDR-269(4240-20)-7; AD-606155)

Chlorine atoms were produced by the photolysis of $COCl_2$ with 2537 A. radiation at 23°. The atoms were quantitatively scavenged by C_2H_4, and the reactions of the resulting radicals were studied. The significant variable in the system is $(C_2H_4)/I_a{}^{1/2}$, which was varied by a factor of 10^4. Only two radicals, C_2H_4Cl and C_4H_8Cl, are important. At high $(C_2H_4)/I_a{}^{1/2}$, the products of the less important $C_6H_{12}Cl$ radical can also be detected. The photochemical products found were CO, 1-C_6H_{12}, C_2H_5Cl, 1-C_4H_9Cl, 1-$C_6H_{13}Cl$, 1,2-$C_2H_4Cl_2$, 1,3-$C_4H_8Cl_2$, 1,4-$C_4H_8Cl_2$, and 1,6-$C_6H_{12}Cl_2$. Also, another C_6 hydrocarbon, a C_4H_7Cl compound, and two $C_6H_{11}Cl$ compounds were detected. Author

N64-32010 Argentina. Comision Nacional de Energia Atomica, Buenos Aires
SEPARATION OF ORTHOPHOSPHATE, PYROPHOSPHATE, AND POLY METAPHOSPHATE ON EXCHANGE RESINS [SEPARACION DE ORTOFOSFATO, PIROFOSFATO Y POLIMETAFOSFATO CON RESINA DE INTERCAMBIO]
Leopoldo J. Anghileri 1964 7 p refs In SPANISH *Its* Informe No. 117

The components were well separated quantitatively with an ample margin of concentrations, as is shown by graphs of radioactivity versus milliliters of eluate. Phosphorus 32 was used as a tracer in each phosphate, and an anion exchange resin (20 to 50 mesh)was used with 0.8 M and 2 M ammonium chloride solutions and with a 2 M NH_4Cl solution in 4-to-1 concentrated NH_4OH. An acid solvent was used in ascending chromatography on paper, which gave R_f values of 0.75, 0.36, and 0.01, respectively, for the three phosphates. Recovery efficiencies for the various phosphates ranged from 94.2% to 99.1%. D.E.W.

N64-32011 Argentina. Comision Nacional de Energia Atomica, Buenos Aires
STABILITY OF TRIIODOTHYRONINE TAGGED WITH I^{131} UNDER DIFFERENT CONDITIONS [ESTABILIDAD DE LA TRIIODOTIRONINA MARCADA CON I^{131} BAJO DIFERNTES CONDICIONES]
Leopoldo J. Anghileri 1964 8 p refs In SPANISH *Its* Informe No. 119

Chromatographic and other techniques are discussed for the determination of impurities and their influence on the stability of triiodothyronine (T-3). The effect that the impurities and the diverse methods of conserving the T-3 have on the stability of the T-3 marked with I^{131} was studied. Ascending chromatography techniques are described. As a consequence of the presence of impurities in the T-3 used for the preparation of radioiodine-tagged T-3, whether the impurities were originally present or were formed by oxidative degradation, it is extremely difficult to explain the possible mechanisms of the reactions of iodation that occur in a solution of I^{131}-tagged triiodothyronine. The experimental work demonstrated the following: (1) The T-3 tagged with I^{131} is more notable in the dry state and at low temperature. (2) A low oxygen pressure improves the stability due to the lesser probability of an oxidation reaction. (3) The presence of its homologs (T-2 and T-4) does not make the stability vary in a significant way. (4) The presence of iodine or free iodide considerably increases the liberation of I^{131}. Trans. by D.E.W.

N64-32053 Joint Publications Research Service, Washington, D.C.
ADDITIVE RELATIONSHIPS FOR CHEMICAL DISPLACEMENTS IN SPECTRA OF MAGNETIC RESONANCE ON NUCLEI OF F^{19} FLUOROPHOSPHATES AND FLUOROPHOSPHONATES
V. F. Bystrov, A. A. Neymysheva, A. U. Stepanyants, and I. L. Knunyants 2 Oct. 1964 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 156, no. 3 p 637–640
(JPRS-26676; TT-64-41934) OTS: $1.00

Nuclear-magnetic-resonance spectroscopy data were obtained to clarify the influence of a substituent on the electron-density distribution in organic fluorine compounds. Determinations were made of chemical displacements and constants of interaction of angular momentum and spin for fluorophosphates, fluorophosphonates, and acid fluorides of carboxylic acids. Results show the dependency of these parameters on the nature of the substituents, and lead to a preliminary conclusion about the dependency of the magnitude of chemical displacement and the reactivity of these compounds. D.E.W.

N64-32093 Argonne National Lab., Ill. Chemistry Div.
THE ELECTRONIC ENERGY LEVELS OF THE HEAVY ACTINIDES $Bk^{+3}(5f^8)$, $Cf^{+3}(5f^9)$, $Es^{+3}(5f^{10})$, AND $Fm^{+3}(5f^{11})$
P. R. Fields, B. G. Wybourne, and W. T. Carnall Jul. 1964 12 p refs
(Contract W-31-109-ENG-38)
(ANL-6911) OTS: $0.50

Tables are given of the electronic energy levels of Cf^{+3}, Es^{+3}, and Fm^{+3}, and of the calculated free-ion levels of the magnetic dipole oscillator strengths for Bk^{+3} through Fm^{+3}, and of the calculated g-values of the ground-state eigenvector of Bk^{+3}, Cf^{+3}, Es^{+3}, and Fm^{+3}. A.W.

N64-32095 Martin Co., Baltimore, Md. Rias Div.
THEORETICAL AND QUANTUM CHEMISTRY OF N, O, F COMPOUNDS Quarterly Technical Report, Apr. 9–Jul. 9, 1964
Joyce J. Kaufman [1964] 33 p refs
(Contract DA-31-124-ARO(D)-203; ARPA Order 542)
(QTR-2; AD-443486)

Pople-LCAO-MO-SCF calculations of the π-systems of NF_2, NF_2^+, and NF_2^- confirm that there is π-bonding in NF_2 and NF_2^+ (although not in NF_2^-) with the positive ion having the greater bond order as expected. The Pople-SCF π-bond orders for the series NF_2, *trans*-N_2F_2 and *cis*-N_2F_2 are found to be correlated with the experimental symmetric stretching frequencies. The ionization potential for NF_2, calculated from the Pople-SCF total energies, is in excellent agreement with experiment; the electron affinity of NF_2 was also calculated. A preliminary rigorous LCAO-MO-SCF calculation was performed on the NF_3 molecule using a program taking gaussians as basic functions. A.W.

N64-32099 Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
THERMAL DEGRADATION OF AN AROMATIC POLYPYROMELLITIMIDE IN AIR AND VACUUM: I. RATES AND ACTIVATION ENERGIES
S. D. Bruck Oct. 1963 33 p refs
(Contract NOw-62-0604-c)
(TG-529; AD-447961)

The thermal degradation of a polypyromellitimide (condensation product of pyromellitic anhydride and an aromatic diamine) was studied in air and vacuum in the range 400° to 700° C by thermogravimetry using a recording electrobalance. Although this organic polymer is remarkably stable in air up to approximately 420° C, at temperatures in excess of this it begins to volatilize. At 485° C practically total volatilization takes place within approximately 5 hr. In vacuum ($\sim 10^{-3}$ mm of Hg), the polymer shows greater heat stability, with no appreciable weight loss even after prolonged exposure to temperatures up to approximately 500° C. Above this temperature it begins to volatilize, leaving a brittle, carbonized residue that appears to reach a limiting weight corresponding to approximately 45% of the original sample, and showing no infrared absorption bands. The rates of volatilization were calculated from the thermal degradation profiles. Author

N64-32133 Polytechnic Inst. of Brooklyn, N.Y.
INTERMOLECULAR FORCES IN CONDENSED PHASES Technical Documentary Report, Dec. 1961–Aug. 1962
Robert P. Bauman Wright-Patterson AFB, Ohio, ASD, Aug. 1963 194 p refs
(Contract AF 33(657)-7757)
(ASD-TDR-63-314, Pt. I & II; AD-421016)

Band contours have been observed for nonpolar molecules in the liquid phase and in solution in nonpolar solvents with a spectral slit width of about 1 cm^{-1}. A criterion was established for measuring the relative amounts of lorentzian and gaussian character to a band. It was found that symmetric bands were lorentzian and that asymmetry appeared as a consequence of intramolecular effects that could be shown to be present in the vapor-phase spectrum. Hydrogen bonding was studied in the mono- and di-hydroxyanthraquinones, by means of infrared spectroscopy, nuclear magnetic resonance, and X-ray diffraction. Infrared spectra were obtained on solutions, solids, and vapors; nuclear magnetic resonance spectra were obtained on solutions; and X-ray diffraction was obtained on a single crystal. Author

N64-32150 Weizmann Inst. of Science, Rehovoth (Israel)
RESEARCH ON MEASUREMENT OF PRESSURE INDUCED SHIFTS OF ABSORPTION LINES IN THE INFRARED SPECTRUM Annual Summary Report No. 3, 1 Dec. 1962—31 Dec. 1963
J. H. Jaffe May 1964 6 p refs
(Contract AF 61(052)-388)
(AFCRL-64-629; AD-603937)

Research dealing with the following is summarized: (1) pressure-induced shifts in emission and absorption spectra; (2) shift oscillation—perturbation of a diatomic molecule (HCl) by a single atom (noble gas) and by other diatomic molecules (DCl, Hf, and HCN by NCl); and (3) spectroscopy at liquid helium temperatures. P.V.E.

N64-32171 Atomic Energy Commission, New Brunswick, N.J.
THE EMISSION SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN PLUTONIUM
A. W. Wenzel and C. E. Pietri Sep. 1964 50 p refs
(NBL-215) OTS: $1.25

Quantitative emission spectrographic methods have been developed for the determination of impurities in plutonium using a spectrograph modified for gloved box operations. In one procedure, plutonium is separated from its impurities by adsorption on an anion-exchange resin in 8N HNO_3 to minimize spectral interference and health hazards. The impurity-rich effluent is analyzed under conditions developed for maximum sensitivity by excitation in a direct current arc using a

gallium oxide matrix. Twenty-two elements (Ag, Al, Am, Ba, Be, Ca, Cd, Cr, Cs, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, V, and Zn) can be determined by this method. The second procedure employs a cation-exchange resin for adsorption of plutonium in 0.2N HNO_3, allowing the impurities to pass into the effluent. The method is used to determine boron and silicon, which cannot be adequately determined using the anion-exchange separation technique. Author

N64-32174 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
AUTOMATIC DETERMINATION OF MELTING POINTS
Emlen Linton Martin, Jr. (M.S. Thesis) Aug. 1963 64 p refs
(GE/EE/63-17; AD-419983)

An automatic melting point apparatus has been designed and a laboratory model fabricated whereby melting points may be determined on transparent or semitransparent crystalline solids. The apparatus uses polarized light to detect changes in birefringence as the solid anisotropic form changes to the isotropic melt. A photoconductor and a thermocouple act as transducers to generate voltages corresponding to light intensity and temperature, respectively, as a sample is heated. These voltages are fed to an X-Y recorder, which provides a permanent record of the melting phenomenon. A qualitative discussion of the properties of crystalline solids and the interaction of these solids with polarized light is included. The equipment, its operation, and directions for use are described in detail. Author

N64-32175 Southwest Research Inst., San Antonio, Tex.
[A STUDY OF RAPID SOLIDIFICATION OF HYDROCARBON FUELS] Monthly Progress Report, 1 Mar.–1 Apr. 1964
E. C. Martin 22 Apr. 1964 17 p
(Contract DA-44-177-TC-819(T))
(AD-447956)

This is a report on evaluation and synthesis of several polyureas as gelling agents for hydrocarbon fuel JP-4. Gel rigidity was evaluated by the Hunter Mechanical Force Gage, and the maximum applied pressure was registered as gel hardness. A gelling system of 3-chlorophenyl isocyanate and 4-chlorobencyl amine in JP-4 provided a very firm, particulate gel with a hardness rating of 125 gr/in.^{2} and with very good burning properties. The M-xylylene diisocyanate and 4-chlorobencyl amine in 4.0 to 2.0 weight percent concentration instantaneously formed a firm, dry particulate gel with a hardness rating of about 395 gr/in.^{2}. The M-xylylene diisocyanate and p-phenetidine in JP-4 had an extremely slow gelation rate but excellent burning characteristics. G.G.

N64-32214 Monsanto Research Corp., Everett, Mass. Boston Lab.
SYNTHESIS OF PANCHROMATIC PHOTOSENSITIZING DYES. PART II. LITERATURE SURVEY Technical Documentary Report, 1 Apr. 1963–31 Mar. 1964
John S. Driscoll and Richard H. Nealey Wright-Patterson AFB, Ohio, AF Avionics Lab., May 1964 35 p refs
(Contract AF 33(657)-11430)
(AL-TDR-64-130, Pt. II, Vol. I; AD-601369)

A critical, abstracted literature survey has been conducted in several areas pertaining to dye sensitized photoreactions with photographic applications. Silver halide sensitizers are covered during the 1961–1962 period. A 1949–1962 thionine dye survey is included. Author

N64-32230* National Bureau of Standards, Washington, D.C.
VAPOR PRESSURES OF RUTHENIUM AND OSMIUM
N. J. Carrera, R. F. Walker, and E. R. Plante Repr. from J. Res. Natl. Bur. Std., A. Phys. and Chem., v. 68A, no. 3, May–Jun. 1964 p 325–330 refs
(NASA Order R-57)
(NBS Paper-68A3-280)

The vapor pressures and heats of sublimation of ruthenium and osmium have been measured using a microbalance technique based on the Langmuir method. Heats of sublimation at 298° K were calculated with the aid of free energy functions. Least squares lines for the vapor pressure data, heats of sublimation, and normal boiling points were obtained and are presented. Author

N64-32268 National Research Corp., Cambridge, Mass. Research Div.
HEATS OF FORMATION OF B_2O_3 (CRYSTALLINE) AND B_2O_3 (AMORPHOUS)
Ludwig G. Fasolino 2 Jun. 1964 16 p refs
(Contract Nonr-3608(00))

From measurements of the heats of solution of B_2O_3 (crystalline), B_2O_3 (amorphous), and H_3BO_3, the heats of formation of B_2O_3 (crystalline) and B_2O_3 (amorphous) were calculated and found to be −303.63 and −299.30, respectively, at ΔHf_{298}, kcal/mole. From this work the following heat of transformation was also calculated:

$$B_2O_3\ (c) \dashrightarrow B_2O_3\ (amorph) \qquad \frac{\Delta H_{298},\ kcal/mole}{+4.33}$$

Author

N64-32290 Argonne National Lab., Ill. Metallurgy Div.
THE CRYSTAL STRUCTURE OF DISODIUM TETRANITRITONITROSOHYDROXYRUTHENATE (III) 2-HYDRATE BY NEUTRON DIFFRACTION Final Report
M. H. Mueller and S. H. Simonsen (Texas U.) Jul. 1964 71 p refs
(Contract W-31-109-ENG-38)
(ANL-6855) OTS: $1.75

The crystal structure of $Na_2[Ru(NO_2)_4(NO)(OH)]\cdot 2H_2O$ was investigated by neutron diffraction, and the positional parameters of the heavy and light atoms were determined. The unit cell is monoclinic: $a_0 = 12.75$; $b_0 = 14.52$; $c_0 = 7.37$A; $\beta = 121.20°$. The space group is C2/m, with 4 molecules (100 atoms) per unit cell, and systematic absences are $h+k = 2n+1$. The structure can be considered as consisting mainly of 6-fold coordination about three central atoms, namely, Ru, Na_1, and Na_2, forming three different kinds of octahedra. These octahedra form an interlocking chain throughout the structure, in which common atoms or common edges are shared between the octahedra. Author

N64-32301 Massachusetts Inst. of Tech., Cambridge
MEASUREMENT OF THERMODYNAMIC PROPERTIES OF COMPOUNDS OF ELEMENTS IN GROUPS II, IV, V AND VI Final Report
Michael B. Bever, Brian W. Howlett, Somnath Misra, Peter M. Robinson, and Peter Beardmore 14 Jul. 1964 39 p refs
(Contract AF 19(604)-5588)
(AFCRL-64-623; AD-447260)

This research was concerned with the measurement and interpretation of thermodynamic properties of certain compounds and solid solutions. The following measurements were made: (1) heats of formation—Sb_2Se_3, Sb_2Te_3, Bi_2Se_3, Bi_2Te_3; Mg_2Ge, Mg_2Sn, Mg_2Pb; In_2Te, InTe, In_2Te_3, In_2Te_5; solid solutions in the systems Bi_2Te_3-Bi_2Se_3 and Sb_2Te_3-Bi_2Te_3; and solid solutions in the system Sb-Bi (preliminary values); (2) energies of order–disorder—certain compositions in the systems Bi_2Te_3-Bi_2Se_3 and Sb_2Te_3-Bi_2Te_3; (3) heats of solution—Mg,

Ge and Pb in Sn; and Sb, Se, and Te in Bi; (4) heats of fusion and melting points—Sb_2Te_3, Bi_2Te_3; Mg_2Sn, Mg_2Pb; and InTe, In_2Te_3; and (5) heat capacities near the melting points—Sb_2Te_3 and Bi_2Te_3. Author

N64-32357 Little (Arthur D.) Inc., Cambridge, Mass.
RADIATION ACTIVATION OF PARA–ORTHO HYDROGEN CATALYSTS Quarterly Progress Report, Nov. 1963–Feb. 1964
Amos J. Leffler Mar. 1964 25 p refs
(Contract AF 33(615)-1362)
(QPR-1; AD-447968)

The discussion of para–ortho hydrogen conversion is based on the concept that catalytic reaction is separate from the transport of the gas through the bed. The conversion process involves a number of steps, and the flow rate determines which step is rate controlling. Equipment described in the literature for the study of para–ortho conversion has been modified for low-temperature operation. A gas chromatograph, constructed for purity determinations, is described. Although test catalysts have been prepared, no runs have as yet been made. Author

N64-32367 Nottingham U. (Gt. Brit.)
PHYSICAL AND CHEMICAL PROPERTIES OF ANHYDROUS METAL NITRATES Annual Technical Report, 1 Jun. 1962–30 May 1963
C. C. Addison 30 Jun. 1963 38 p refs
(Contract DA-91-591-EUC-2389)
(ATR-23; AD-420959)

The crystal structure of the anhydrous 1:1 complex of copper nitrate with nitromethane has now been completed, and the report gives a full description of the structure. The copper atoms exhibit the more unusual 5-coordination. Each copper atom is surrounded by a square plane of oxygen atoms, each from different nitrate groups; one oxygen atom from a nitromethane molecule lies on the axis of this plane, giving square-pyramidal configuration for each copper atom. The nitrate groups form bridges linking successive pyramids to form infinite sheets. In the complex $Cu(NO_3)_2 \cdot 2MeCN$, indications are that copper atoms are in a distorted octahedral environment with methyl cyanide molecules in *cis*-positions. The reactions of lead IV and tin IV acetates with dinitrogen tetroxide give acetate–nitrates as intermediate or final products. These reactions are discussed in the light of the oxidizing powers of the nitrate group in this environment, and the influence of the valency state of the metal. Author

N64-32369 Allied Chemical Corp., Morristown, N.J. General Chemical Div.
HIGH PRESSURE-BASIC RESEARCH PROGRAM Interim Technical Report, May 1, 1962–Mar. 31, 1964
W. H. Mears, E. S. Jones, R. J. Chandross, P. N. La Mori, K. P. Murphy et al [1964] 51 p refs
(Contract DA-30-069-ORD-3551)
(AROD-3177-3; AD-447217)

Using piston-cylinder equipment of the Kennedy type, research was conducted on organic fluorocarbon reactions and on inorganic synthesis in the system boron-phosphorus-nitrogen-carbon. An encapsulation technique for low-boiling fluorocarbon gases is described. Author

N64-32370 Brookhaven National Lab., Upton, N.Y.
OXIDATION RATES OF ALTERNATELY IRRADIATED AND ANNEALED GRAPHITE
Donald G. Schweitzer and Robert M. Singer [1964] 23 p refs
(BNL-7567-R2)

In this study, the oxidation properties of AIA graphites were determined and compared to similar measurements on continuously irradiated graphite. Oxidation rates were determined in air at 360°, 400°, 440°, and 495° C. No trend was observed between the rate of oxidation and the total dose or the prior irradiation temperature. Oxidation rates and activation energies for unirradiated graphite and for nine AIA samples with c-axis values from 6.73 to 6.90 K_x units show that the oxidation rate does not depend on either the c-axis value or the irradiation temperature at any oxidation temperature. As to size effects, the results showed that smaller samples have oxidation rates greater than the larger samples. Specific but unknown interstitial complexes are held responsible for increases in oxidation rate observed after the first irradiation. The effect of an extended continuous neutron irradiation on the oxidation of graphite is still not known. A continuous irradiation (110 days) leads to greater enhancement and a lower activation energy than irradiation 10 times greater. A.W.

N64-32414 Iowa State U. of Science and Tech., Ames Ames Lab.
EQUILIBRIA AND KINETICS OF THE REACTION OF PHOSGENE WITH THORIUM OXIDE
D. T. Peterson and D. J. Sundquist Jul. 1964 30 p refs
(Contract W-7405-ENG-82)
(IS-917) OTS: $0.75

The reaction of phosgene with thorium oxide has been shown to be a good method for preparing thorium tetrachloride. The equilibria of the reaction showed that nearly complete utilization of phosgene could be attained in a properly designed reactor. The kinetics of the reaction could not be represented by a simple rate law, but the effects of bed depth, particle size, mode of oxide preparation, and temperature on the rate of reaction were established. The depth of the bed of thorium oxide and the particle size of the oxide did not affect the initial rate of reaction. At high conversions the rate of the reaction was probably controlled by the slow solid-state diffusion of oxygen to the surface of the thorium tetrachloride crystals, and the highest conversion of thorium oxide to thorium tetrachloride obtained was approximately 91%. Author

N64-32415 Oak Ridge National Lab., Tenn.
THERMODYNAMIC CALCULATIONS RELATING TO CHLORIDE VOLATILITY PROCESSING OF NUCLEAR FUELS. II: THE CAPACITY OF CHLORINE FOR TRANSPORTING PLUTONIUM TETRACHLORIDE VAPOR DURING REACTION OF U_3O_8-PuO_2 WITH CARBON TETRACHLORIDE
T. A. Gens Oct. 1964 38 p refs
(Contract W-7405-ENG-26)
(ORNL-3693) OTS: $1.00

The capacity of chlorine gas for transporting plutonium tetrachloride vapor in the presence of UCl_5 and UCl_6 formed in the reaction of U_3O_8-PuO_2 with carbon tetrachloride vapor at 1 atm was estimated from free-energy data as a function of temperature between 500° and 1050° K and the amounts of chlorine and inert gas introduced. It was determined that the presence of UCl_5 and UCl_6 has little effect on the capacity of chlorine for transporting $PuCl_4$. This capacity can be estimated closely from the capacity in the $PuCl_3$-Cl_2 system in the absence of uranium chlorides, where it increases from about 3×10^{-6} to 10^{-2} mole of $PuCl_4$ per mole of chlorine as the temperature increases from 700 to 1000° K. The capacity is sufficient to transport the plutonium produced by neutron irradiation of natural or slightly enriched uranium oxide fuels, where the maximum plutonium content expected after long-term irradiation exposure is less than 1 wt %. Thus, simultaneous volatilization and transportation of plutonium and uranium should be feasible. Author

N64-32441 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.

ANALYTICAL METHODS TO STUDY KINETICS OF FERMENTATION

John A. Christopulos Jun. 1964 15 p refs

(USAEL-TR-2483; AD-605922)

The volumetric determination of ethanol in the presence of glucose, buffer salts, and yeast requires a special analytical technique similar to that for determining alcohol in blood. In the special technique as described in this report the yeast cells, which would chemically interfere with the volumetric determination, are flocculated with lead acetate followed by centrifugation (greater than 2800 rpm). The clarified samples (4 to 6 ml) were found to be yeast-free and ready for subsequent glucose and ethanol determination. The glucose rest concentration of clarified samples was then determined by measurement of the optical rotation with a polarimeter. Knowing this rest concentration of glucose and its stoichiometric equivalent of dichromate, a correction factor was calculated. This correction factor was then used in the oxidimetric determination of ethanol. The oxidimetric titration for determination of ethanol was performed with potassium dichromate. Author

N64-32442 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.

EFFECTS OF IONIZING RADIATION ON PYRIDINE

Carol K. Pearce Jul. 1964 13 p refs

(USAEL-TR-2485; AD-605430)

Irradiation of liquid pyridine has been found to produce polypyridines and hydrogen and acetylene gases. A mechanism has been presented to explain the products and yields observed. Some conclusions related to the use of pyridine compounds for electronic devices are discussed. Author

N64-32446 Aberdeen Proving Ground, Md. Coating and Chemical Lab.

DETERGENCY—MICELLAR RELATIONSHIPS OF AN ANIONIC–NONIONIC SURFACTANT MIXTURE

A. Mankowich 22 May 1964 20 p refs

(CCL-163; AD-605685) OTS: $0.75

The micellar characteristics of the mixed micelles formed by three ratios of an anionic–nonionic surfactant mixture have been compared with the detergencies imparted by the three combinations to aqueous alkaline cleaning solutions of about pH 12. It was found that detergency increases with increasing charge on, and number of anionic monomers in, the mixed micelle. Improved detergency appears to be connected to a reduction in micellar dissociation. Author

N64-32453 Royal Coll. of Science and Tech., Glasgow (Gt. Brit.)

PREPARATION OF NOVEL ORGANOMETALLIC COMPOUNDS OF THE TRANSITION ELEMENTS Third Quarterly Technical Status Report, 1 Mar.–31 May 1964

P. L. Pauson [1964] 8 p

(Contract DA-91-591-EUC-3101)

(AD-449203)

The first use of a pyrrole bearing a functional substituent in the synthesis of a manganese complex (I; R = Me) was reported previously. This has been extended to the lower homolog 3-acetyl-2-methylpyrrole, which affords the analogous complex (I; R = H); both these pyrroles have been used in the preparation of appropriately substituted azaferrocenes. Reinvestigation of the reaction of indolylpotassium with iododicarbonylcyclopentadienyliron not only confirmed the formation of dicarbonyl σ-indolylcyclopentadienyliron, but led also to the isolation of the expected π-indolylcyclopentadienyliron, as an unstable oil identified spectroscopically. The structure of the dicarbonyldiallyliron described in the preceding report has now been confirmed by its synthesis from allylmagnesium chloride and iodotricarbonylallyliron. Author

N64-32459 Victoria U. of Manchester (Gt. Brit.)

THE THERMOCHEMISTRY OF ALKYLS OF TIN AND GERMANIUM Quarterly Technical Status Report No. 2, Dec. 1963–Mar. 1964

G. A. Nash, W. F. Stack, and H. A. Skinner 31 Mar. 1964 10 p refs

(Contract DA-91-591-EUC-3095)

(AD-448759)

Redistribution reactions of tin alkyls with stannic chloride were investigated with particular attention given to the tetravinyl tin–$SnCl_4$ system. The heats of mixing obtained for different rates of mixing and for different molar ratios of the reactants are tabulated. The results agree fairly well with the Allen bond-energy scheme. M.P.G.

N64-32460 General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.

THE CHEMICAL KINETICS OF SODIUM IN RE-ENTRY

M. H. Bortner 16 Jun. 1964 98 p refs

(Contracts AF 04(694)-222; AF 04(694)-486)

(Rept.-64SD810; AD-449218)

A study of the complete chemical kinetics of sodium is described herein. The radiation is subject to considerable collision limiting (nonequilibrium excitation and deexcitation). The ionization processes cannot be assumed to be instantaneous and the deionization processes are very slow. The major reaction is the ionization–deionization system, found to be $Na + O \rightleftharpoons Na^+ + O^-$, although other reactions, both of this type and other types, contribute appreciably, depending on the conditions. Included in this report is a recommended chemical system, with rate constants, for use in any nonequilibrium calculations of the effects of sodium in reentry. Author

N64-32462 Thiokol Chemical Corp., Trenton, N.J. Chemical Operations

NITROSO RUBBER RESEARCH, DEVELOPMENT AND PRODUCTION, 1 DECEMBER 1963–29 FEBRUARY 1964

Joseph Green [1964] 23 p refs

(Contract DA-19-129-AMC-69(X))

(RD-343-Q4; RMD-8576-Q4; AD-449220)

The preparative process for CF_3CO_2NO has been modified for larger scale operation. Production of pure CF_3CO_2NO, CF_3NO, and C_2F_4 has been continued. The preparation of C_6F_5NO was also continued, but the synthesis of carboxy-substituted fluorinated aromatic nitroso compounds has not yet been effected. A CF_3NO/C_2F_4 copolymer of >1 300 000 molecular weight has been prepared. Terpolymers containing C_6F_5NO in varying ratios were prepared, and compounding and cure studies were initiated. Author

N64-32471 Space Technology Labs., Inc., Redondo Park, Calif. Quantum Physics Lab.

RESEARCH ON PHOTOTROPIC DYE-ENZYME SYSTEMS Second Quarter Informal Progress Report, 15 Jan.–15 Apr. 1964

J. L. Kropp and R. S. Moore 24 Apr. 1964 22 p

(Contract AF 33(657)-11108)

(STL-4133-6002-RU000; AD-448773)

This report describes research studies on the phototropic properties of dye–enzyme systems. Attention has been focused on the malachite green–sodium bisulfite–papain system with a view to obtaining a detailed understanding of the mechanism

of the dye–enzyme interaction. The following progress has been made: (1) Standard methods of preparing activated papain and assaying its enzymatic activity have been developed. (2) The fading time of the colored form of the dye back to the leucocompound depends both on bisulfite–dye ratio and on pH. (3) Activated papain is found to decrease the fading time of the colored form of the dye. (4) Papain decreases the photochemical fatigue of the dye solutions. (5) In quartz cells irradiation removes the dye with the production of a precipitate. Pyrex cells largely prevent this. Author

N64-32484 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMPARATIVE CHARACTERISTICS OF THE SPECTROPHOTOMETRIC METHODS OF IDENTIFYING TANTALUM AND NIOBIUM. II: APPLICATION OF ORGANIC REAGENTS
A. T. Pilipenko and O. M. Yeremenko 27 Aug. 1964 13 p refs Transl. into ENGLISH from Ukrain. Khim (Zhur. (Kiev), v. 29, no. 5, 1963 p 538-547
(FTD-TT-64-455/1+2; AD-605800)

The relative inhibiting action of tantalum and niobium is studied, and also the effect of titanium in the detection of tantalum and niobium. Titanium almost always accompanies these elements and is especially inhibitive to their identification. All the results were obtained with the spectrophotometer SF-4. Author

N64-32485 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE INTERACTION OF HEXAALKYLDISILAZANES WITH CARBOXYLIC ACIDS AND DIATOMIC PHENOLS
K. A. Andrianov, V. V. Astakhin, and B. P. Nikiforov 3 Sep. 1964 6 p refs Transl. into ENGLISH from Zh. Obshch. Khim. (Moscow), v. 34, no. 3, 1964 p 914–916
(RSIC-264; AD-606244)

In this work the reactions of the cleavage of hexaalkyldisilazanes by saturated monobasic and dibasic acids and diatomic phenols were investigated. Hexamethyldisilazane, acetic, propionic, and adipic acids, hydroquinone and resorcinol were used as the starting materials in the investigation. In the course of the investigation it was established that hexaalkyldisilazanes react with the acids according to the following equations:

$$R_3SiNHSiR_3 + 3R'COOH \rightarrow 2R_3SiOOCR' + R'COONH_4$$
$$R_3SiNHSiR_3 + HOOC(CH_2)_xCOOH \rightarrow R_3SiOOC(CH_2)_xCOOSiR_3 + NH_3$$
$$R = CH_3C_2H_5$$

With dihydric phenols, hexaalkyldisilazanes interact according to the formula

$$R_3SiNHSiR_3 + Ar(OH)_2 \rightarrow Ar(OSiR_3)_2 + NH_3,$$

where Ar represents a divalent aromatic radical. The properties of the compounds obtained are summarized in the table. Author

N64-32494 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
STUDY OF THE HYDRATION OF PROTEINS BY THERMOGRAVIMETRY
Clement Duval and Ladislas Robert 3 Sep. 1964 5 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 238, 1954 p 235–243
(RSIC-260; AD-606060)

Thermogravimetric investigation by continuous or isothermal heating of various proteins (treated or untreated with acetaldehyde) and high polymers (casein, gelatin, fibrin, edestin, bovine serum albumin, protamin, nylon, rilsan) is discussed. Measurements carried out with regard to studying the dry weight of a protein are discussed in particular. P.V.E.

N64-32500 Texas A&M U., College Station Activation Analysis Research Lab.
MODERN TRENDS IN ACTIVATION ANALYSIS
Mildred W. Brown, ed. [1961] 179 p refs Proc. of the 1961 Conf., held at College Station, Tex., 15–16 Dec. 1961 Jointly Sponsored by AEC and the Intern. Atomic Energy Agency Available from Texas A&M U., Activation Analysis Res. Lab., College Station: $15.00

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10. NEUTRON ACTIVATION ANALYSIS FOR CHARACTERIZATION OF INDUCED ACTIVITY IN IRRADIATED FOODS Paul Kruger (Hazelton-Nuclear Sci. Corp.) Irwin J. Gruverman (Nuclear Sci. and Engr. Corp.) p 46–49 refs

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17. A COMBINATION OF CHEMICAL AND PHYSICOCHEMICAL METHODS FOR A SYSTEMATIC SEPARATION OF LARGE NUMBERS OF RADIOISOTOPES ON ONE EXPERIMENTAL ANALYSIS OF ALUMINUM, IRON AND ZIRCONIUM BY RADIOACTIVATION P. Albert p 86–94

N64-32506 Victoria U. of Manchester (Gt. Brit.)
THE THERMOCHEMISTRY OF ALKYLS OF TIN AND GERMANIUM Quarterly Technical Status Report, Apr.–Jun. 1964
G. A. Nash, W. F. Stack, and H. A. Skinner 30 Jun. 1964 12 p refs
(Contract DA-91-591-EUC-3095)
(QTSR-3; AD-449205)

Studies on the redistribution reactions of tin alkyls with stannic chloride have been virtually completed, and bomb-combustion studies on tin alkyls have been renewed. Measurements of the heat of combustion of tetra-isopropyl tin are completed and are reported. Author

N64-32516 Leicester U. (Gt. Brit.)
A STUDY OF ION-ION AND ION-SOLVENT INTERACTIONS Second Quarterly Technical Status Report, May–Jun. 1964
M. C. R. Symons [1964] 5 p refs
(Contract DA-91-591-EUC-3195)
(AD-449206)

Previously obtained electron-spin resonance and ultraviolet absorption spectra of solvated ions are discussed in terms of a square-well model. This model is the simplest that can accommodate the marked dependence of F-center transitions upon the lattice parameter *a*. Similarities are found between electrons in water and electrons in iodide vacancies in crystals, whereas electrons in ammonia appear to be in somewhat larger cavities. M.P.G.

N64-32531 Naval Research Lab., Washington, D.C. Chemistry Div.
HYDROLYSIS OF OIL-DISPERSED AMINE SALTS
M. A. Scheiman and H. R. Baker 20 Jul. 1964 13 p refs
(MRL-6081; AD-605318) OTS: $0.50

The water-insoluble reaction products between a series of amines and phenylstearic acid and dinonylnaphthalenesulfonic acid were chosen as structurally determinate prototypes of ashless "salt" rust inhibitors. The stabilities of such additives dissolved in an organic phase in contact with aqueous phases of varying pH and CO_2 content were investigated. Results were reported as percent hydrolysis, i.e., percent of nitrogen originally present in the organic phase that was found in the aqueous phase at the termination of the reaction. Salt stability depends on an acid displacement mechanism wherein a strong acid displaces the anion conjugate of a weaker acid from its salt. The extent to which the amine component of the amine phenylstearate salts is extracted by water parallels the water solubility of the amine component. The effect is further enhanced by the presence of carbon dioxide. Author

N64-32547 Union Carbide Research Inst., Tarrytown, N.Y.
RESEARCH ON PHYSICAL AND CHEMICAL PRINCIPLES AFFECTING HIGH TEMPERATURE MATERIALS FOR ROCKET NOZZLES Quarterly Progress Report, 1 Jul.–30, Sep. 1964
Robert Lowrie 30 Sep. 1964 81 p refs
(Contract DA-30-069-ORD-2787; ARPA Order 34-63)
(AD-448482)

Data were obtained on the corrosion of W by CO_2–Ar mixtures, with CO_2 stagnation partial pressures of 40, 81, 122, 192, and 340-torr at 2325° to 3000° K, and 340-torr total stagnation pressure. The reaction rate is linear with time. Design improvements were made in the high-pressure stagnation-flow reactor. The corrosion of tungsten by CO_2 at a stagnation pressure of 1033 torr from 2080° to 2850° K was measured. A linear plot of log of corrosion rate against 1/T was obtained up to about 2650° K with an apparent activation energy comparable to that obtained in the low-pressure reactor. The accuracy of the least-squares program for computing lattice parameters was checked by determining the lattice parameter of a tungsten sample from measurements of the positions of the peaks and centers of gravity of the lines with the Siemens diffractometer. A.W.

N64-32557 Florida U., Gainesville College of Engineering
FLUOROCARBON N-F COMPOUNDS Final Report, Aug. 1, 1959–Jun. 26, 1964
R. D. Dresdner [1964] 26 p refs
(Contract DA-01-009-ORD-772; ARPA Order-40-59)
(AD-445279)

Summaries of work carried out with respect to the following are presented: (1) laboratory-scale preparation of N_2F_4; (2) preparation of primary perfluoroalkyl amines; (3) indirect fluorination of some fluorocarbon nitrogen derivatives; (4) monoacyl, diacyl, triacyl, and tetraacyl derivatives, oxidiazoles, and ω-bromo acyl isocyanates; (5) reaction of nitriles with carboxylic acids; (6) the N,N-difluoroamines from azoalkanes; (7) electrolysis of pyridine in anhydrous HF; (8) the CsF catalyzed fluorocarbon reactions involving generation of a fluorocarbon carbon ion; (9) gamma irradiation of C_5F_8 isomers; (10) reaction chemistry of N_2F_4 with ultraviolet stimulus; and (11) reactions of high-valency metal fluorides with $R_fN{=}SF_2$. P.V.E.

N64-32564 Humble Oil and Refining Co., Baytown, Tex.
IONIC REACTIONS IN GASEOUS ACETYLENE
M. S. B. Munson Sep. 1964 29 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(HUM-8-P; AD-449401)

Mass spectrometric studies of ionic reactions in acetylene have been made that gave rate constants of 0.9 and 1.3 × 10^{-9} cc/molecule-sec. for reaction of $C_2H_2^+$ and C_2H^+. Consecutive ionic reactions were observed giving ionic species up to C_{12} and perhaps C_{14}. The $C_4H_4^+$ was observed as a third-order product ion with no indications of chemi-ionization reactions being involved in its formation. No $C_6H_6^+$ ions were observed. Product ions were observed that were apparently formed by the reaction of excited states of the acetylene ion. Analogous reactions were observed in C_2D_2, and the rate constant for reaction of $C_2D_2^+$ was within experimental errors, the same as the rate constant for reaction of $C_2H_2^+$. Author

N64-32572 Rock Island Arsenal Lab., Ill.
EVALUATION OF PRESENT METHODS OF DETERMINING THE SOAP CONTENT OF GREASES
Robert L. Peterson 30 Jul. 1964 15 p
(RIA-64-2363; AD-449743)

Three methods of analysis were compared. They were the ASTM Method D128, the ASTM D128 Supplementary Method using a Soxhlet apparatus with a paper extraction filter, and

a variation of ASTM D128 substituting 10% acetic acid for 10% hydrochloric acid as the initial breakdown acid. The following information was obtained from this investigation: (1) The supplementary method of ASTM D128 has the best repeatability of the three methods evaluated except when used in the breakdown of an aluminum soap-thickened grease. (2) There is no significant trend as to which acid breakdown method is better from the point of repeatability. (3) The digestion time is shortened by substituting acetic acid for hydrochloric acid as the initial breakdown acid except in the analysis of an aluminum soap-thickened grease. Author

N64-32573 Group for the Advancement of Spectroscopic Methods, Paris (France)
SCIENTIFIC REPORT
6 Feb. 1964 10 p refs
(Contract AF 61(052)-369)
(AFCRL-64-358; AD-603086)

This paper describes a high-resolution spectrograph with a double-pass grating and a multiple-pass gas tank having a sufficient amount of gas for the light to go through, for the observations of fine structures. Rotation–vibration theories and properties of linear atomic molecules are discussed with regard to transition frequency in an excited vibrational state, rotational resonance and structure, and application of the Hamiltonian in resonance and expansion calculations. G.G.

N64-32581 Michigan U., Ann Arbor Coll. of Literature, Science, and the Arts
INFRARED STUDIES: STARK EFFECTS IN HCN, CH_3F, CH_3I, NH_3 AND H_2O. HINDERED ROTATION IN H_2O_2. INFRARED ABSORPTION OF MATRIX ISOLATED NH_3 Final Report
Robert H. Hunt, Paul D. Maker, Robert E. Meredith, and C. W. Peters Aug. 1964 8 p
(Contract AF 19(604)-6125)
(AFCRL-64-668; Rept.-03640-4-F)

Abstracts are presented of papers covering the following: (1) the stark effects observed in some polyatomic molecules; (2) the results of the study of the far infrared spectrum of H_2O_2; and (3) the infrared absorption of ammonia isolated in condensed inert gases. A.W.

N64-32666 University Coll. of Wales, Aberystwyth (Gt. Brit.) Edward Davies Chemical Lab.
SPECTROSCOPIC STUDIES: THE PREDICTION OF CONFORMATION FROM BOND STRETCHING FREQUENCIES, PART 4 Scientific Report No. 10
E. W. Jones and W. J. Orville-Thomas 7 Jul. 1964 11 p refs
(Contract AF 61(052)-691)
(AFCRL-64-744; AD-606673)

A study on $X\text{-}CH_2\text{-}CH_2\text{-}Y$ molecules shows that a relation exists between the CX-bond stretching frequency and the electronegativity product $\chi(X)\,\chi(Y)$ when X and Y are in the *trans* position. This correlation is used to demonstrate that the gauche isomer is the more stable conformer for $ClCH_2\text{-}CH_2CN$ and $BrCH_2\text{-}CH_2CN$. Author

N64-32667 Uppsala U. (Sweden) Quantum Chemistry Group
SOME REMARKS ON THE PARISER-PARR-POPLE METHOD Scientific Report No. 12
Kimio Ohno 15 Apr. 1964 21 p refs *Its* Preprint No. 117 Also issued by the Florida Quantum Theory Project as Report No. 52
(Contract AF 61(052)-701)
(ARL-64-203; AD-606669)

Basic assumptions that characterize the Pariser–Parr–Pople method of computing molecular electronic wave functions are critically examined. By restricted variational calculation of the valence state of carbon and nitrogen atoms and ions, it is demonstrated that the usual methods of evaluation of one-center Coulomb integrals and atomic core energies are rather good. A semitheoretical means of estimating the core resonance integral is proposed and shown to give fair agreement with the empirical values for C—C, O—O, C—N, and C—O bonds. Author

N64-32684 Harshaw Chemical Co., Cleveland, Ohio Central Research Lab.
INVESTIGATION OF THE EXISTENCE OF OXYANIONS OF FLUORINE AND NITROGEN AND THE NITROGEN-FLUORINE CATIONS Quarterly Technical Summary Report, 28 Apr.–28 Jul. 1964
Gerald L. Hurst and S. I. Khayat 28 Aug. 1964 17 p
(Contract DA-31-124-ARO(D)-76)) ARPA Order-402)
(HQ-76-6; AD-445027)

Results obtained from various investigations include the following: (1) nitrogen trifluoride is reduced to ammonium ion by aqueous ferrous sulfate at 60° C; (2) the hydrolysis of NF_3 is catalyzed by aqueous $FeCl_3$ at 100° C; (3) measurable hydrolysis of N_2F_4 at 60° C occurs only after an induction period that varies with the pressure of N_2F_4 and the presence of impurities; (4) the hydrolysis of N_2F_4 is autocatalytic—the reaction is accelerated by the nitric oxide produced; (5) the mechanism of the hydrolysis of N_2F_4 probably involves direct attack by OH^- at 60° C; (6) the N_2F_4 reacts readily with $AlCl_3$ at temperatures as low as −112° C; and (7) the reaction of N_2F_4 with $AlCl_3$ involves the formation of an N_2F_4-aluminum halide adduct that is stable below −132° C. P.V.E.

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities. Research and Support. *For related information see* 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-31446* National Aeronautics and Space Administration, Washington, D.C.
QUASI-OPTICAL METHODS FOR THE SHAPING AND TRANSMISSION OF MILLIMETRIC WAVES [KVAZIOPTICHESKIYE METODY FORMIROVANIYA I PEREDACHI MILLIMETROVYKH VOLN]
B. Z. Katsenelenbaum Jul. 1964 39 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 83, no. 1, 1964 p 81–105
(NASA-TT-F-9028) OTS: $2.00 fs; $0.50 mf

This paper discusses the application of optical methods to millimeter and submillimeter radio waves by the following: (1) the use of mirrors, prisms, and lenses in a very wide circular waveguide in which the energy is transmitted in the form of a single wave; (2) open resonators as used in lasers; and (3) lenses, or analog mirror lines, suitable for radio-wave transmission with small losses, by means of multiplex retransmission on a narrow beam. G.G.

N64-31475 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LENS ANTENNA WITH ROLLING BEAM IN A WIDE SECTOR

Yu. A. Zaytsev 15 Jul. 1964 13 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), v. 18, no. 11, 1963 p 20-26
(FTD-TT-64-628/1+2; AD-605472)

This report is devoted to the calculation of an antenna, assuring radiation pattern control of the "pencil" type at greater speed and in broader limits. The antenna represents a side surface of a truncated cone with "focusing" structure attached to it. To sweep the side surface of a cone, a Luneberg-type flat lens is used. Author

N64-31562* National Aeronautics and Space Administration, Washington, D.C.

RECEPTION THRESHOLD FOR FREQUENCY MODULATION. ESTIMATION OF THE THEORETICAL LIMIT OF ITS IMPROVEMENT [SUR LE SEUIL DE RECEPTION EN MODULATION DE FREQUENCE: ESTIMATION DE LA LIMITE THEORIQUE A SON AMELIORATION]

Gerard Battail Sep. 1964 80 p refs Transl. into ENGLISH from Ann. Telecomm. (France), v. 19, no. 1–2, 1964 p 1–28
(NASA-TT-F-9043) OTS: $3.00 fs; $0.50 mf

An appropriate theoretical derivation is presented for the extreme position of the reception threshold for wideband FM. The method requires no detailed knowledge of the optimal demodulator that would make it possible to attain this limit. The threshold effect is interpreted for the case of a continuous-modulation system that provides a reduction in noise at the expense of the occupied bandwidth; topological arguments in signal space in Shannon's representation make it possible to distinguish two contributions to the noise after demodulation (neighborhood and error effects). The first is dominant above the threshold, the second below it; the threshold is defined as the point where the two are equal in power. The first can be evaluated by a linear approximation; the second requires quantization of the modulating signal. Author

N64-31634 Aerospace Corp., El Segundo, Calif. Electronics Div.

ON OPTIMAL LINEAR FILTERING IN THE PRESENCE OF CORRELATED MEASUREMENT NOISE

James S. Meditch 27 Aug. 1964 22 p refs
(Contract AF 04(695)-469)
(TDR-469(5540-10)-1; SSD-TDR-64-150; AD-447343)

The problem of optimal linear filtering for discrete linear processes in which the measurement noise is correlated is reformulated as a linear filtering problem that involves uncorrelated noise. The latter problem is of higher dimension than the former, but it can be solved by standard techniques. The resulting optimal filter and estimation-error covariance equations are partitioned and placed in a form that is especially suited for digital computation. The result is that the effects of increased dimensionality on computer program complexity are minimized. Author

N64-31636 AirTechnology Corp., Cambridge, Mass.

STUDY OF DIRECTIVE VLF ANTENNAS FOR RECEPTION OF TRANSPOLAR SFERICS FROM THE CONTINENTAL UNITED STATES Final Report

Roger E. Clapp, James C. Maxwell, and C. Harold Colburn 30 Aug. 1963 135 p refs *Its* Rept. No. 169–1
(Contract AF 19(628)-1697)
(AFCRL-63-371; AD-448341)

Directive VLF antennas were studied to determine their feasibility to receive transpolar sferics with minimal interference from sferics of tropical origin. A high front-to-back-lobe ratio and very low back lobes extending over a 120° to 180° angular sector are required. A practicable Beverage antenna is unsuitable because of its low front-to-back ratio. The cardioid antenna null angle is too narrow. Superdirective arrays of spaced elements (two or three) are inadequate because of insufficiently low side lobes and the requirement for extremely tight equipment tolerances. A specialized 15-element endfire array, using two quadrature elements at each end, has been designed and in theory has proved suitable for the required application; a suitable site has been recommended for its construction and demonstration; installation methods and costs are discussed. Author

N64-31640 Naval Missile Center, Point Mugu, Calif. Avionics Div.

EFFECTS OF TELEVISION BANDWIDTH ON TARGET IDENTIFICATION

Dennis Shanahan 3 Apr. 1964 14 p ref
(NMC-TM-64-2; AD-435746)

Tests were designed to idealize the operation of a possible television-command-guidance missile system. To eliminate undesired test variables, the targets were Landolt rings of known sizes and contrast ratios. The results indicate the following: (1) Reducing the target contrast ratio degrades target identification abilities. (2) Reducing the video signal bandwidth degrades target identification abilities. (3) The ability to identify targets is degraded less by video bandwidth reductions for low-contrast targets than it is by high-contrast targets. (4) The ability to identify targets is degraded less by target contrast-ratio reductions when using a narrow video bandwidth rather than when using a wide video bandwidth. It is emphasized that, because of the highly idealized parameters used in the tests, the results are no more than indicative and are not to be considered suitable as working values for a television guidance system. Author

N64-31678 Illinois U., Urbana Coordinated Science Lab.

PROPERTIES OF LOSSY COMMUNICATION NETS

W. Mayeda and M. E. Van Valkenburg Apr. 1964 20 p refs
(Contract DA-36-039-AMC-02208(E))
(R-200; AD-439437)

The relationship between a lossy communication net and the linear graph is accomplished by the introduction of a basic saturated cut set. By knowing the existence of these cut sets, the relationship between terminal capacities is established: For any vertices i, j, and k, then either $\bar{t}_{ij} \geq \bar{t}_{kj}$ or $\bar{t}_{ij} \geq \bar{t}_{ik}$ where $\bar{t}_{pq}$ is the source terminal capacity, which is the maximum flow at the source vertex in order to receive the maximum flow at q, and t_{pq} is the sink terminal capacity, which is the maximum flow that can be received at q when the maximum flow is sent from p to q. The property analogous to the S-submatrix property in the lossless case is also obtained. All results given reduce to known results when the loss of every edge becomes zero. This includes the maximum flow–minimum cut theory of Ford and Fulkerson, which is applicable only in the lossless case. Author

N64-31682 Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.

PLASMA PRODUCED ANTENNA PATTERN DISTORTION Physical Sciences Research Papers No. 28

Daniel J. Jacavanco Jun. 1964 30 p refs
(AFCRL-64-511; AD-605271)

This report describes an experimental attempt to determine and measure the antenna pattern distortion produced by a layer of plasma. A brief theoretical and experimental summary of the problem is given, followed by the theory pertaining to this particular experimental geometry. The complete experiment, including the generation and measurement of the plasma, the vacuum system, and the antenna pattern measuring equipment is described in detail. Results are presented and compared with the theoretical predictions. Author

N64-31687 Ohio State U. Research Foundation, Columbus, Antenna Lab.
FIELDS IN THE FOCAL REGION OF A PARABOLIC RECEIVING ANTENNA
E. M. Kennaugh and R. H. Ott 31 Aug. 1963 45 p refs
(Contract AF 33(616)-8039)
(Rept.-1223-16; AD-420437)

This report is devoted to the representation by multipole expansions of the electromagnetic fields within a paraboloidal reflector for the case of plane wave illumination along the symmetry axis and the use of such expansions in the design of parabolic reflectors and feeds. The asymptotic solution for the fields in the focal plane and along the symmetry axis is represented in the form of a finite series of spherical wave functions. Calculated results are shown for parabolas having focal length-to-diameter ratios from 0.298 to 0.931. Author

N64-31688 Ohio State U. Research Foundation, Columbus Antenna Lab.
STUDY PROGRAM RELATED TO SHIPBOARD ANTENNA SYSTEM ENVIRONMENT Interim Report, 7 Sep. 1962–3 May 1963
1 Jun. 1963 31 p
(Contract N-123(953)-3166A)
(Rept.-1522-3; AD-422346)

This report summarizes work completed thus far on the problems of shipboard communication systems, particularly that of rf interference. Three areas are described: (1) the study of phased arrays, low-coupled antennas, and optimum gain arrays; (2) servocontrolled nulling for interchannel interference reduction; and (3) field methods for decoupled antennas. Author

N64-31718* Northrop Space Labs., Huntsville, Ala. Space System Section
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES: GROUND WAVE PROPAGATION ON THE LUNAR SURFACE
J. D. Hughlett, Jr. Huntsville, Ala., NASA Marshall Space Flight Center, Oct. 1964 27 p refs
(Contract NAS8-11096)
(NASA-CR-61014) OTS: $2.00 fs; $0.50 mf

This report presents a digital-computer program for an optimum frequency on the lunar surface. It is based upon mobile operations and limited for antennas resonating at frequencies less than 0.1 wavelength. Also, it is designed for the given parameters as stated in the Section titled "Computer Program." A section follows on direction-finding antennas, discussing the loop antenna and four vertical monopoles with a goniometer. Emphasis was placed upon the loop antenna, with findings indicating that increased efficiency can be gained by introducing low-loss ferrite cores into the windings, the exact percent efficiency depending upon the material chosen. An overall block diagram is shown, illustrating a proposed complete transistorized medium-frequency subsystem operating at 1.5 megacycles for voice communication. Author

N64-31803 Air Force Cambridge Research Labs., Bedford, Mass.
DOLPH–TCHEBYSCHEFF ARRAYS OF MANY ELEMENTS AND ARBITRARY UNIFORM SPACING Physical Sciences Research Papers No. 31
Charles J. Drane, Jr. Jun. 1964 39 p refs
(AFCRL-64-344; AD-605810)

The optimum design of Dolph–Chebyshev broadside arrays of an odd number of elements presents definite computational problems in terms of existing excitation coefficient design procedures, particularly for element spacings of less than a half-wavelength. This paper presents approximate representations for these coefficients in terms of Bessel functions for arrays of, say, more than 20 elements of arbitrary but uniform spacing. To facilitate comparison of the approximations with exact theory, graphs and tables are presented for various main beam–sidelobe ratios, numbers of array elements, and element spacing. Author

N64-31813 Air Force Cambridge Research Labs., Bedford, Mass.
THE MODIFICATION OF ELECTROMAGNETIC SCATTERING CROSS SECTIONS IN THE RESONANT REGION. A SYMPOSIUM RECORD, VOLUME I Special Reports No. 6
J. K. Schindler and R. B. Mack, ed. Sep. 1964 181 p refs
Symp. held at L. G. Hanscom Field, Bedford, Mass., 4 Jun. 1963
(AFCRL-64-727(I); AD-606106)

Papers in the present volume establish the need for techniques that significantly reduce the electromagnetic scattering cross section of bodies in the frequency range where wavelength is comparable to the body size. One technique that holds promise for use in the resonance region is impedance loading of the body surface. This technique is discussed in several papers. Other papers give results demonstrating the effects that material properties have in changing cross sections in the resonant region. Author

N64-31831 Illinois U., Urbana Antenna Lab.
PROPAGATION IN A WAVEGUIDE WITH GLIDE REFLECTION SYMMETRY
R. Mittra and S. R. Laxpati Apr. 1964 55 p refs
(Contract AF 33(657)-10474)
(TR-75; AD-601227)

An exact formulation of the boundary-value problem for an iris loaded infinite periodic waveguide with glide reflection symmetry has been obtained. Only the TM type of waves have been considered, and slot walls have been assumed to be vanishingly thin. An infinite set of equations for various space harmonic amplitudes and the propagation constant β_0 as unknown have been derived. The approximate determinantal equation for the propagation constant has been obtained from the above infinite set of equations, under the assumption that the slot width is small compared to free space wavelength and the slot depth. It has been demonstrated that the effective period of this waveguide is d/2, as expected from the application of the generalized Floquet theorem, and is not d, its translational period. This conclusion is based on the periodicity of the solution of the determinantal equation. Author

N64-31856 Joint Publications Research Service, Washington, D.C.
APPLICATION OF THE METHOD OF CHANGING AMPLITUDES TO TRACKING SYSTEMS OF ALTERNATE CURRENT
Ye. I. Baranchuk and Ye. L. Kovarskaya *In its* Izv. VUZov Instr. Building, No. 3, 1964 23 Sep. 1964 p 29–38 refs
(See N64-31851 23-15) OTS: $5.00

This article discusses development of a method for determining transfer functions of tracking systems of alternate current by means of rounding images. Stability conditions of the system are obtained with various stabilizing arrangements according to the inner resistance of power booster and other parameters of the system. Author

N64-31889 Mitre Corp., Bedford, Mass.
INTERPRETATION AND COMPARISON OF OUTPUT SIGNALS FROM LINEAR-FM PULSE-COMPRESSION SYSTEMS

M.H. Ueberschaer Aug. 1964 42 p refs
(Contract AF 19(628)-2390)
(ESD-TDR-64-129; TM-03984; AD-606319)

Comparisons are made analytically as well as graphically with respect to several pertinent parameters. It is shown that if the phase and envelope measurements of signals returned from an actual target were to be interpreted as though the signal had undergone a doppler shift (instead of a time dilation), a considerable error would result for high target velocities. The feasibility of using an all-pulse-compression system for obtaining accurate estimates of radar target parameters is demonstrated. Simple analytic expressions, which describe the phase and envelope quite well during the time of measurement, are presented, and a procedure for properly interpreting the data is indicated. Author

N64-31890 Mitre Corp., Bedford, Mass.
REVIEW AND ANALYSIS OF TELEMETRY LINK DATA BY TYPE AND OCCURRENCE OF DEVIATIONS
R.J. Williamson Aug. 1964 41 p ref
(Contract AF 19(628)-2390)
(ESD-TDR-64-131; TM03699/0000/01/0/00; AD-606318)

The numbers of occurrences of the different types of deviations in telemetry links from the Telemetry Standards presented by the Inter-Range Instrumentation Group in its Document No. 106-60 are tabulated and plotted. The general trends indicated by these tables and graphs are discussed for nine general classes of deviations. D.E.W.

N64-31891 Mitre Corp., Bedford, Mass.
ELECTRONIC TRACKING ERRORS VERSUS PLASMA EFFECTS
J. Hoffman Aug. 1964 33 p refs
(Contract AF 19(628)-2390)
(ESD-TDR-64-74; TM-3865; AD-606317)

Plasma-generated electronic tracking errors were investigated for both reentry and flame plasma. Simple models were used to calculate order-of-magnitude errors generated by reentry and flame-plasma effects in typical tracking systems. For the simple model considered, the errors for flame plasma are greater than for reentry plasma. This is mainly because the plume is considerably larger than the plasma sheath. D.E.W.

N64-31908 Federal Scientific Corp., New York, N.Y.
A STUDY OF SIGNIFICANT PARAMETERS OF SPEECH FOR APPLICATION IN AUTOMATIC SPEECH RECOGNITION SYSTEMS Final Report
Griffiss AFB, N.Y., RADC, Jul. 1964 94 p refs
(Contract AF 30(602)-3131)
(RADC-TDR-64-196; AD-604348)

The major emphasis was placed on obtaining data for evaluation of critical instants of speech. Critical instants are defined as instants during normal speech when the variation in the values of key speech parameters is a minimum. Because of the reduced data spread at such instants they will prove to be valuable points at which to sample parameters for use in speech recognition patterns, and will result in higher pattern efficiencies. Procedures are described for the location of critical instants and for evaluation of their significance for use in recognition patterns. To facilitate these evaluations, modifications were made in a previously developed computer program for extraction of speech parameters, and a new subroutine was added to permit automatic detection of critical instants in a large volume of speech data, and sampling of appropriate parameters at those instants. Included in the new subroutine is an effective procedure for roughly classifying phonemes as vowel, glide, fricative, or plosive types. Author

N64-31933 CBS Labs., Stamford, Conn.
PERSONNEL COMMUNICATIONS IN SPACE—A STUDY OF SPEECH TRANSMISSION AND HELMET COMFORT Technical Documentary Report, Jan. 1963–Jun. 1964
Benjamin B. Bauer, Alfred L. Dimattia, and Allan J. Rosenheck Wright-Patterson AFB, Ohio, AF Avionics Lab., Sep. 1964 80 p refs
(Contract AF 33(657)-10737)
(CLD-1707; AL-TDR-64-175; AD-605891)

A high-performance noise-canceling microphone was investigated. Its superior characteristics were confirmed by psychoacoustic comparisons with other operational types. A study of microphone arrays is reported. A unique space helmet was developed providing freedom of lateral head motion and featuring off-the-head transducers in its communication system. These features make possible predicted long-comfort tolerance compared with presently used helmets. The new helmet additionally offers the excellent promise of significant noise reduction, good thermal insulation, and acoustic stability with comfortable sidetone level. Author

N64-31946 Honeywell, Seattle, Wash. Development Lab.
TELEPHONE CHANNEL MONITOR Final Report
C. R. Abbey, H. H. Pursel, and J. T. Richardson Griffiss AFB, N.Y., RADC, Aug. 1964 190 p
(Contract AF 30(602)-3190)
(SDL-1195; RADC-TDR-64-228; AD-606473)

This report covers the results of a test program whose objective was to establish the feasibility of measuring basic telephone circuit quality, on a noninterfering basis, while the circuits were actively employed. The measuring equipment utilized spread spectrum and correlation techniques for inserting and extracting a test signal from a phone line while normal data signals were present. The test program demonstrated in a measure the feasibility of the basic spread spectrum concept for determining line quality on a noninterfering basis. Author

N64-31948 Johns Hopkins U., Baltimore, Md. Carlyle Barton Lab.
MULTIPATH TRANSMISSION FROM AN INACCESSIBLE SOURCE
F. C. Ogg, Jr., and P. J. Butterly Griffiss AFB, N.Y., RADC, Aug. 1964 37 p refs
(Contract AF 30(602)-2597)
(RADC-TDR-64-284; AD-605680)

The problem of obtaining reliable reception from an inaccessible transmitter under multipath propagation conditions may be considered in terms of the following two problems: (1) the derivation of a filter for the elimination or reduction of multipath effects; and (2) the estimation of the multipath channel parameters necessary for the implementation of this filter from a knowledge of the received signal alone. This report assumes that the more important phenomena associated with ionospheric propagation may be described in terms of a simple model of the transmission medium. This model serves as a starting point for the derivation of a filter, the purpose of which is the elimination of waveform distortion introduced by the medium. The autocorrelation function of the received signal is used to estimate the filter parameters corresponding to the prevailing channel structure. The operation of the filter in both time and frequency domains is described, and some limiting features of the method of filter parameter estimation are discussed. Author

N64-31984 General Dynamics/Astronautics, San Diego, Calif.
RESEARCH DIRECTED TOWARD THE INVESTIGATION OF SUITABILITY OF THE GLOTRAC TYPE G TRANSPONDER FOR USE IN THE RANGE CALIBRATION SATELLITE, VOLUME II, PART C Final Report
R. Braun 1 Jul. 1964 71 p refs
(Contract AF 19(628)-3274)
(GD/A-63-1195-(C), Vol. II; AFCRL-64-240-(C); AD-605766)

The report covers three areas of investigation of the GLOTRAC transponder: (1) The transponder testing in accordance with the electromagnetic interference requirements and the test results are discussed. (2) The development of a breadboard line filter is described that allows the GLOTRAC transponder to meet the electromagnetic interference requirements. (3) An investigation of the temperature stability problems of the GLOTRAC-received signal-strength telemetry circuit is discussed. Author

N64-31988 Lowell Technological Inst. Research Foundation, Mass.
STUDY OF TECHNIQUES FOR COMPUTER PROCESSING OF TELEMETERED SIGNALS FROM ROCKET AND SATELLITE BORNE SPECTRA Final Report, 15 Mar. 1961–14 Mar. 1964
Henry A. Miranda, Jr. and Robert J. Le Coz Jun. 1964 56 p
(Contract AF 19(604)-8071)
(AFCRL-64-504; AD-606255)

Work associated with the processing of telemetered signals from rocket-borne and airborne spectra is described. This report presents the results of analytical studies, modifications, and calibrations carried out on a number of electro-optical instruments, including Ebert spectrometers and various special photometers. In addition, a mirror aiming device for installation aboard a KC-135 aircraft is outlined. Author

N64-31989 Alford (Andrew) Consulting Engineers, Boston, Mass.
EXPERIMENTAL STUDY OF THE BACK SCATTERING FROM CONDUCTING OBJECTS IN THE RANGE OF ONE QUARTER TO ONE WAVELENGTH IN SIZE Final Report
David P. Flood and John C. Field Apr. 1964 59 p refs
(Contract AF 19(628)-2456)
(AFCRL-64-541; AD-606087)

The primary purpose of this study was to reduce the magnitude of the backscattering from objects by introducing reactive or other loading. A system was developed to measure the relative phase and magnitude of the backscattered fields. This phase and magnitude information was extremely valuable in the reduction of backscattering by means of reactive loading. A number of objects were detuned by means of reactive loading. The detuned objects included regular polyhedrons, dipole and monopole elements, cylinders, and planar structures. The objects' backscattering cross sections were reduced 15 to 20 dB or more at the frequency of minimum backscattering. Some bandwidths obtained were in order of 15% to 30% for reduction of 15 dB in cross section. Author

N64-31995 New Hampshire U., Durham Antenna Systems Lab.
PARAMETRIC AMPLIFIER ANTENNA STRUCTURES Final Report, Feb. 1962–Sep. 1964
Albert D. Frost 1 Sep. 1964 30 p refs
(Contract AF 19(628)-307)
(AFCRL-64-648; AD-606309)

A summary is presented of theoretical and experimental work carried out in connection with a study of the factor affecting the design and performance of parametric amplifier antennas. Results of tests to verify previously tabulated dual coaxial line coefficients are reported, together with a final summary of the status of attempts to realize the antenna amplifier in slot form. Author

N64-31997 Boston Coll., Chestnut Hill, Mass. Ionospheric Research Lab.
DETERMINATION OF THE IMPEDANCE OF AN ANTENNA FROM SLOTTED LINE MEASUREMENTS ACCOUNT TAKEN OF THE ATTENUATION OF THE LINE Scientific Report No. 2 (Final)
Rene J. Marcou and Richard W. Doherty 15 May 1964 17 p
(Contracts AF 19(604)-7304; DASA-WEBB-07.007)
(AFCRL-64-682; AD-606188)

A method is developed for determining the electrical degree distances between tap points on a slotted line, with the attenuation of the line taken into account. Formulas are also developed, taking into account the attenuation of the line, for the determination of the parameters used in the calculation of the impedance of a given load. An analysis using the voltage values at three tap points on the line is developed for the parameters $|V_1|$, $|V_2|$, δ and for the impedance. A separate analysis using the voltage values at six tap points is developed for the parameter δ. Author

N64-32056 Jackson and Moreland, Inc., Boston, Mass.
POWER DISTRIBUTION FOR HIGH-RELIABILITY QUADRUPLE-DIVERSITY COMMUNICATIONS SYSTEMS
A. E. Fitzgerald Feb. 1963 21 p
(AD-601253) OTS: $2.00

The following features are recommended as a result of a study of a conceptual power-distribution layout suitable for high-reliability quadruple-diversity communication-system stations having a six-engine generator, double-bus primary powerplant: (1) two generators manually transferable between busses; (2) two nontransferable generators per bus; (3) technical and interruptible electronics loads manually transferable between busses; (4) half the utility load connected to each bus and not transferable between busses; and (5) interruptible electronics and utility loads on either bus shed automatically upon loss of an operating generator on that bus. M.P.G.

N64-32062 Cornell U., Ithaca, N.Y. Electrical Engineering Research Lab.
ADAPTIVE RECOGNITION OF RANDOM BINARY SIGNALS Technical Report No. 80
G. Beine Jun. 1964 45 p refs
(Contract DA-36-039-AMC-00034(E))
(EERL-7; AD-601982) OTS: $2.00

The problem of this study is the detection of signals that are neither periodic nor of constant waveshape in the presence of white noise. It is assumed that the signals are initially known, that they are of a binary form, that they are modified at random times by the complementing of one randomly chosen bit, and that they occur at random times. An adaptive matched filter, based upon the link connection, is proposed. Several methods for estimating the input-signal waveform from its samples, including finite averaging, finite summation, and RC averaging, are discussed. Miss and false-alarm probabilities for the system are computed, estimated, or bounded, and its general behavior, from initial matching to noise-induced failure, is described. Author

N64-32063 Lincoln Lab., Mass. Inst. of Tech., Lexington
ON THE ACCURACY AND RESOLUTION OF RADAR SIGNALS Group Report 1964–23
F. C. Schweppe 25 Jun. 1964 43 p refs
(AD-601986) OTS: $2.00

Information matrices are derived for estimates of the range parameters of moving targets as obtained by combining a priori information (if available) with reflected radar signals observed in the presence of additive white gaussian noise. The inverse of the information matrix provides a lower bound on the covariance matrix of any unbiased parameter estimates. This bound can be approached with a high signal-to-noise ratio and optimum data processing (matched filters). Arbitrary frequency modulation, amplitude modulation and target motion, as well as various assumptions on processing the rf phase, are considered. The multiple target case enables investigation of a signal's resolution ability as well as its accuracy potentials. Results for a carrier frequency much greater than the effect signal bandwidth are obtained as a special case. A main purpose of the report is the reduction of the original radar problem to a linear model, which is equivalent in the sense of having the same information matrix. Author

N64-32075 National Bureau of Standards, Boulder, Colo. Boulder Labs.
TROPOSPHERIC RADIO PROPAGATION ON AN OVERSEA PATH IN THE GULF OF MEXICO
M. T. Decker and F. O. Guiraud May 1964 48 p refs
(NBS-8429)

Results of one year's measurement of radio propagation at 1828 and 1848 MHz on a beyond-the-horizon oversea path in the Gulf of Mexico are reported. Approximately 5000 hourly medians of system loss from each of two receiving antennas are included. These hourly medians show an annual variation of over 70 db. A comparison is made of measured and predicted values of system loss. Author

N64-32079 Litton Systems, Inc., Waltham, Mass. Communication Sciences Lab.
ERROR PROBABILITIES FOR UNCODED M-ARY TRANSMISSION OF D-ARY DATA
Albert H. Nuttall 1 Aug. 1963 30 p refs
(Contract Nonr-3320(00))
(TR-63-6-BF; AD-420125)

The error probabilities for uncoded multiple alternative transmission of the output of a discrete data source are derived generally and are evaluated numerically for a sample case. Specifically, the source emits D-ary equiprobable messages (information digits), which are represented by (associated with) an M-ary alphabet (transmission digits) so as to minimize the average symbol length in the M-ary representation. One of the M signals is transmitted, and an M-ary decision is made in the receiver. A sequence of these received digits is then reassociated into the information alphabet. For the particular case of phase-coherent reception in a nonfading additive gaussian noise channel, comparison of different transmission alphabets (different M) for a given source (given D) is accomplished under the constraints of equal source data rate, average signal power, and average noise power. Author

N64-32080 Litton Systems, Inc., Waltham, Mass. Communication Sciences Lab.
ERROR PROBABILITIES FOR SOME GENERAL CLASSES OF NON-ORTHOGONAL M-ARY SIGNALS UNDER PHASE-COHERENT RECEPTION
Albert H. Nuttall 1 Sep. 1963 21 p refs
(Contract Nonr-3320(00))
(TR-63-7-BF; AD-419991)

The error probabilities for some general classes of non-orthogonal M-ary signals are derived under conditions of synchronized phase-coherent reception in a nonfading single-path channel subject to additive white gaussian noise. The results are in the form of untabulated low-order multiple integrals that are amenable to computer evaluation. Author

N64-32083 North American Aviation, Inc., Canoga Park, Calif. Space and Information Systems Div.
EXPERIMENTAL LASER SPACE COMMUNICATIONS PROGRAM. TASK I: PROBLEM DEFINITION, VOLUME I
9 Oct. 1964 93 p refs
(SID-64-1894-1)

This paper covers the following types of problem definitions for an analytical laser space-communications program: "Types of Optical Effects Associated with Turbulence"; "Summary of Available Measurements"; "Meteorological Optics"; "Theoretical Treatment of Atmospheric Effects"; and "Signal Transfer Analysis." G.G.

N64-32087 Raytheon Co., Portsmouth, R.I. Submarine Signal Div.
DETECTION OF RANDOM ACOUSTIC SIGNALS BY RECEIVERS WITH DISTRIBUTED ELEMENTS. OPTIMUM RECEIVER STRUCTURES FOR NORMAL SIGNAL AND NOISE FIELDS
David Middleton and H. L. Groginsky Aug. 1963 67 p refs
(Contract Nonr-3381(00))
(R297; AD-420829)

This paper deals with the passive detection of noiselike signals in the presence of both external (environmental) noise and self-generated (receiver) noise, using an array of transducers. Starting with the Bayesian formulation of the general detection problem, a set of matrix integral equations is derived whose solution yields the optimum detector function. By regarding the resultant time-varying filters as operators, and the defining matrix integral equations as a set of operational equations, it is possible to examine the underlying structure of the optimum detector most easily. It is shown thereby that factorization of the space–time operations (i.e., separation of the required filter into two successive operations, the first depending only on the geometry of the array, the second depending only on the statistics of the noise processes) is not, in general, possible in optimum systems. Only in the strong signal case has it been possible to show that factorization analogous to conventional beam forming can be utilized in optimum array detection. Author

N64-32094 Lincoln Lab., Mass. Inst. of Tech., Lexington Electronics Systems Div.
SPACE COMMUNICATIONS Quarterly Progress Report, Division 6, 1 Mar.–31 May 1964
G. P. Dinneen and W. E. Morrow, Jr. 15 Jun. 1964 26 p ref
(Contract AF 19(628)-500)
(ESD-TDR-64-336; AD-602973)

Brief reports are given on the status of a number of projects that are grouped under the headings of radio-frequency components, surface techniques and equipment, space techniques and equipment, analysis, radar, and engineering. The work on analysis includes propagation measurements, multiple access studies, and communications theory; the radar work is concerned with the Haystack Project and with space communications. D.E.W.

N64-32100 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
A DIGITAL SIMULATION OF RADIATION PATTERNS OF UHF ANTENNA ARRAYS
David Carlton Luke (M.S. Thesis) Aug. 1963 121 p refs
(GE/EE/63-16; AD-420011)

Basic models for the simulation of the radiation patterns of ultrahigh frequency antenna arrays above finitely conducting plane surfaces are developed with the application of digital computer techniques. The data required for a simulation are: the free-space radiation pattern of the antenna, the height of the antenna, and the conductivity and permittivity of the surface. Simulations of several antenna arrays are presented. A complete set of reflection factor curves are included for horizontal and vertical polarization. Author

N64-32103 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
MODAL ANAYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS
L. B. Felsen and N. Marcuvitz 22 May 1964 126 p refs
(Contract AF 19(604)-7499)
(PIBMRI-1225-64; AFCRL-64-557; AD-606512)

Approximate methods for solving the transmission line equations in variable media are given for the following cases: $a_0(x)$ has no zeros or poles (WKB solutions); $a_0(x)$ has a simple zero; $a_0(x)$ has two neighboring simple zeros; $a(x,\Omega)$ has a simple pole; and a (x,Ω) has a neighboring simple pole and simple zero. In a separate analysis of radiation problems in plane stratified regions, sources in the presence of media with continuous spatial variation are considered, and the limits of application of the equations of geometrical optics to plane stratified media are discussed. M.P.G.

N64-32107 Radio Corp. of America, Burlington, Mass.
RECOMMENDATIONS FOR IMPROVEMENT OF AN/TSQ-47 RELATIVE TO SYSTEM INTEGRATION TESTS Final Report
James J. Lauginiger, Robert P. Morin, and Emmett H. Reid Bedford, Mass., AFSC, Electron. Systems Div., Feb. 1964 125 p
(Contract AF 19(604)-8020)
(ESD-TDR-64-251; AD-604025)

This report gives recommendations for improvements of the AN/TSQ-47 Air Traffic Control and Communications System. A description of the system and of major subsystems is included, as is a discussion of its operation and its SIF/IFF compatibility. Other recommendations include improvement of communications control and audio distribution, improvement of the landline subsystem, use of hybrid couplers for additional isolation of vhf and uhf equipment on the same antenna, and improvements of the microwave subsystem.
D.E.W.

N64-32109 Technical U., Copenhagen (Denmark) Lab. of Electromagnetic Theory
RADIATION FIELDS ASSOCIATED WITH SHORT-WAVE ANTENNAS IN ARBITRARY LAND-SEA AREAS Final Technical Report
Tove Larsen Apr. 1964 19 p refs
(Contract AF 61(052)-503)
(S75-R37; AFCRL-64-457; AD-603047)

The compensation theorem method was examined, compared with other theoretical methods, then applied to the problems of sky-wave radiation from antennas placed near a straight line boundary between different media; both the two-media and the three-media cases were considered. A direct electronic computer treatment of the case of arbitrary boundaries is discussed, and a modified form of the well-known Fresnel zone concept is introduced. Author

N64-32116 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
FIELD STRENGTH MEASUREMENTS, PHASE I Final Report
A. C. Stewart and E. L. Kilpatrick 5 Aug. 1964 66 p refs
(Contract AF 30(602)-2385)
(RADC-TDR-64-106; AD-606978)

Experience with field-strength measurements in practical situations at high frequency and above reveals variability and a lack of reproducibility between measurements taken under apparently identical conditions. The field-strength measurement study program was undertaken in order to gain a better understanding of the nature of the difficulties and to develop techniques for more accurate measurement and for more significant interpretation of the measured data. The program included the testing and evaluation of commercial and military field-strength meters. It also included a study of the interpretation of field-strength measurement data taken under multipath conditions. Author

N64-32117 Litton Systems, Inc., Waltham, Mass. Information Sciences Lab.
VOICE IDENTIFICATION TECHNIQUES Final Report
W. Floyd Griffiss AFB, N.Y., RADC, Sep. 1964 110 p refs
(Contract AF 30(602)-3043)
(RADC-TDR-64-312; AD-606634)

The problem of designing a machine that can identify automatically a speaker by processing samples of his speech has been investigated. Through construction of special purpose equipment and digital computer simulation, the fundamental operations of speech clue extraction and voice recognition have been implemented in a manner designed to render voice identification by a machine insensitive to the effects of noise and speech bandwidth truncation. Results of experiments indicate that the extraction of certain spectral, voice fundamental, and speaking cadence characteristics of speech can lead to reliable identification of a speaker's voice, even in undesirable speaking and speech transmission environments. Author

N64-32142 Texas U., Austin Electrical Engineering Research Lab.
RESEARCH ON ELECTROMAGNETIC WAVE PROPAGATION EFFECTS IN DYNAMIC SITUATIONS Quarterly Engineering Report No. 4, 1 Feb.–30 Apr. 1963
[1963] 6 p
(Contract AF 33(657)-8716)
(AD-403887)

Measurement in the laboratory's 500-foot absorption cell of the intensity and shape of the 118.75 kMc/sec oxygen line at gas pressures between 0.5 and 760 mm of Hg and frequencies ±0.4 kMc/sec of the line center frequency have been completed. The line center attenuation and line half intensity-half width are approximately 1.4 dB/km and 2 Mc/sec per mm of Hg respectively, for atmospheric oxygen at a temperature of 300°K and pressures where collisional broadening predominates. Author

N64-32149 General Electric Co., Syracuse, N.Y. Radio Guidance Operation
GENERAL TEST PLAN FOR PROJECT FIRE
F. B. Esposito 20 Jan. 1964 29 p
(Contract AF 04(695)-475)
(Rept.-64A240; AD-447843)

The general test plan is presented for the Radio Tracking System and Missileborne Guidance System to be used in the FIRE program. Periodic and dynamic checkout procedures and test specifications are given. The data processing and evaluation activities are described for equipment performance and for analysis of the data, with respect to accuracy. D.S.G.

N64-32162 HRB-Singer, Inc., State College, Pa.
A HUMAN FACTORS REVIEW OF THE AN/TSQ-47 AIR TRAFFIC CONTROL/COMMUNICATIONS SYSTEM
Allen C. Busch and Robert B. King Bedford, Mass., AF Systems Command, Electron. Systems Div., Jun. 1964 47 p refs (Contract AF 19(628)-439)
(Rept.-353-R-6; ESD-TDR-64-446; AD-606629)

Testing has recently been completed on the AN/TSQ-47 Mobile Air Traffic Control/Communications System. This report presents a review of human factors problems that occurred during the testing phase and in prior development phases of the system. Each shelter is reviewed separately, and problems common to all system facilities are discussed. The major topics of review are the operational considerations for each shelter, the working environment, and the design of consoles and work places. Author

N64-32181 Harvard U., Cambridge, Mass. Gordon Mc Kay Lab.
RESEARCH ON THE PROPERTIES OF ANTENNAS IN A CONDUCTING MEDIA Scientific Report No. 8 (Final)
Keigo Iizuka 15 Apr. 1964 66 p refs
(Contract AF 19(604)-7262; Grant NSF G-20225)
(AFCRL-64-436; AD-603635)

The types of the antenna studied include bare or insulated dipole antennas and a bare circular loop antenna. The dimensions of the media were either finite or infinite in extent. A detailed illustration of the experimental setup is included. Author

N64-32187 Lincoln Lab., Mass. Inst. of Tech., Lexington
CALIBRATED RADAR AMPLITUDES FOR TRAILBLAZER Im
E. C. Gronroos and J. C. Howard 24 Apr. 1964 29 p refs
(Contract AF 19(628)-500; ARPA Order 13)
(RP-5; AD-447830)

The report presents calibrated radar amplitude records obtained at S-band, uhf, and X-band during the flight of the Trailblazer I vehicle, which is a six-stage solid-fuel rocket. The calibrated radar-amplitude records can be used to compute the actual received power, the system signal-to-noise ratio on each stage, and the target radar cross-section characteristics. These analog amplitude records were taken in real time and provide an immediate continuous monitor of the performance of the vehicle and of the radar system. All radar-amplitude parameters were recorded on magnetic tape at 320 pulses/second and 960 pulses/second, and on 35-mm film at 320 pulses/second and 960 pulses/second. The trajectory parameters of range, azimuth, and elevation are recorded at 40 points/second. A.W.

N64-32216 Cornell U., Ithaca, N.Y. Center for Radiophysics and Space Research
RADIO ASTRONOMY: STATUS REPORT NO. 28
T. Gold et al 30 Sep. 1963 4 p
(Contract Nonr-401(27))
(RR-RS53; AD-422286)

The crossed-dipole feed was adjusted for optimum performance in the 17-foot dish with the following results; for dipole A and B: E-plane beam width 8°; H-plane beam width 10°; E-plane sidelobe −18 dB; and H-plane sidelobe level −20 dB. Results are given of SWR for dipole A: 1.04, and for dipole B: 1.05. A.W.

N64-32226 Joint Publications Research Service, Washington, D.C.
PROBLEMS OF WAVE-DIFFRACTION AND PROPAGATION. VOLUME III: RADIO-WAVE PROPAGATION, NO. 3
22 Sep. 1964 236 p refs Transl. into ENGLISH of "Problemy Difraktsii i Rasprostraneniya Voln. Rasprost Raneniye Radio-Voln" Leningrad State U., 1964
(JPRS-26487; TT-64-41745) OTS: $6.00

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N64-32227 Joint Publications Research Service, Washington, D.C.
PROPAGATION OF ELECTROMAGNETIC PULSES AND THEIR HARMONICS OVER THE EARTH'S SURFACE
E. M. Gyunninen, G. I. Makarov, V. V. Novikov, and S. T. Rybachek *In its* Probl. of Wave-Diffraction and Propagation Vol. III Radio-wave Propagation, No. 3 22 Sep. 1964 p 1–195 refs (See N64-32226 23-08) OTS: $6.00

Formulas are presented for computing the field of a vertical electric dipole along the earth's surface, for stationary transmission. These formulas are then considered as expressions for the individual spectral components of pulses in order to obtain the field of the dipole in the case of pulsed radiation. Methods of computation and the results obtained are discussed, and graphs and tables are presented that give the spectral characteristics of the transmission path. In the tables, the values are given of the modulus and argument and also of the real and imaginary parts of the attenuation functions for various soils, frequencies, and distances from the source. D.E.W.

N64-32228 Joint Publications Research Service, Washington, D.C.
COMPUTATION OF THE REFLECTION COEFFICIENT FOR A SMOOTH, INHOMOGENEOUS LAYER
N. S. Gavrilova, O. N. Loginova, and G. I. Makarov *In its* Probl. of Wave-Diffraction and Propagation. Vol. III Radio-Wave Propagation, No. 3 22 Sep. 1964 p 196–207 refs (See N64-32226 23-08) OTS: $6.00

The following model of an inhomogeneous layer is adopted in this paper:

$$\varepsilon_m(z) = \begin{cases} 1, z < z_{\Gamma P} \\ 1 - \dfrac{CP_n(z)}{f(f + i\,\frac{\gamma}{2\pi})}, z \geq z_{\Gamma P}. \end{cases}$$

The numerical integration of Maxwell's equations for inhomogeneous layers is presented, and the solution obtained is compared with the asymptotic solutions found in previously published papers. Results are displayed in several graphs. D.E.W.

N64-32229 Joint Publications Research Service, Washington, D.C.
APPROXIMATION METHODS FOR COMPUTING AND SIMULATING TRANSIENT PROCESSES IN RADIO-WAVE PROPAGATION
V. M. Rysakov *In its* Probl. of Wave-Diffraction and Propagation. Vol. III: Radio-Wave Propagation, No. 3 22 Sep. 1964 p 208–231 refs (See N64-32226 23-08) OTS: $6.00

Approximation methods for computing the transient processes in the propagation of radio waves over a plane earth are investigated. With the aid of these methods, compact solutions can be obtained with an accuracy of 20% for pulses of more simple shape. For pulses of arbitrary shape (in particular, of a shape determined by an oscillograph), the problem can be solved quickly with the aid of a special simulating assembly, the basic principles of which are also considered. A brief description is given of the constructed model of such an assembly and of some of the results obtained with it. D.E.W.

N64-32233 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NOISE IMMUNITY OF TELEVISION SYSTEMS. RANDOM NOISE IN TELEVISION
N. N. Krasil'nikov 17 Jun. 1964 302 p refs Transl. into ENGLISH from "Pomekhoustoychivost' Televizionnykh Ustroystv Flyuktuatsionnyye Shumy v Televidenii" Moscow, Gos. Energ. Izd., 1961 p 1–267
(FTD-TT-62-1661/1+2+4; AD-603550)

This book examines the problems of the occurrence of random noise in television systems and its passage through the amplification channel. On the basis of the statistical structure of the signal and the noise, as well as of the basic parameters of the television system, there is developed an expression for the noisiness of the picture with the aid of which it is possible to uniquely determine the visibility of noise in the picture. The book examines the effect of noise on the observability of small details in the picture and particularly the effect on the resolution of the television system. Author

N64-32253 General Dynamics/Fort Worth, Tex.
AN ANALYSIS OF THE SCATTERING MATRIX MEASUREMENT CAPABILITIES OF A GROUND PLANE RADAR CROSS SECTION RANGE Final Report
R. A. Ross and C. C. Freeny Griffiss AFB, N.Y., RADC, Jun. 1964 81 p refs
(Contract AF 30(602)-2831)
(FZE-222-4; RADC-TDR-64-317; AD-605519)

The concept of the polarization scattering matrix is presented. Measurement techniques leading to the determination of the scattering matrix on a radar range are discussed. The polarization dependence of measurements on a ground plane range are noted. Matrix-determination techniques are examined in the context of ground-plane-range operation. The utility of performing scattering matrix measurements on the RAT SCAT range is discussed. Finally a specific measurement technique is chosen for the scattering matrix solution; consideration of operational ease and measurement accuracy forms the basis of this choice. Author

N64-32256 Texas Western Coll., El Paso Schellenger Research Labs.
THE EFFECT OF TURBULENT PRESSURE CORRELATION OF MULTIPORT MICROPHONES
E. A. Dean and G. G. Maxwell *In* AERDA Atmospheric Acoust. Propagation [1964] p 29–52 refs (See N64-32254 23-23)
(Contract DA-36-039-AMC-03218(E))

Open-field measurements were made of the correlation between the outputs of two hot-wire microphones separated at various distances. The effect of correlation on signal-to-noise quality was investigated, and the following are discussed with respect to the results obtained: harmonic analysis of noise, total noise power, deviation of correlation and power, correlation as a function of noise power, correlation as a function of height, correlation as a function of frequency, and correlation as function of distance. P.V.E.

N64-32257 Texas Western Coll., El Paso Schellenger Research Labs.
ACOUSTIC CONSIDERATIONS CONCERNING A DEVICE FOR THE REDUCTION OF WIND NOISE (THE PIPE ARRAY)
H. N. Ballard and M. Izquierdo *In* AERDA Atmospheric Acoust. Propagation [1964] p 53–84 refs (See N64-32254 23-23)

Discussed is an investigation carried out to improve the performance of a pipe array and an associated sensor. The array is a pipe 100 feet in length, with abrupt changes in cross-section area at several intervals along the pipe. At the center of the pipe is a T-section to which is connected the acoustic sensor. At equal 2-foot intervals along the pipe openings are placed into the main pipe. Discussed in particular are studies related to the following: (1) the development of an acoustic source consisting of a piston source, pressure chamber, and flexible connecting tubing of variable lengths to represent waves approaching the pipe array with angles of incidence that vary from 90° to 0° ; and (2) a continuing investigation of the frequency and directivity characteristics of the pipe array by making use of the acoustic source. P.V.E.

N64-32394 Aerospace Research, Inc., Boston, Mass.
DESIGN AND FABRICATION OF A SLEDBORNE MULTICOUPLER Final Report, 15 Mar.–1 Dec. 1963
Dec. 1963 16 p
(Contract AF 29(600)-4048)
(ARI-Publ.-185; AD-602893)

A summary is given of work on an extremely rugged multicoupler that couples six transmitters to one antenna in the frequency range of 800 to 820 Mc/sec, with an isolation of at least 20 dB between channels. The multicoupler was designed for use on a rocket sled. Specifications, design considerations, construction, and test results are presented. Author

N64-32445 Harry Diamond Labs., Washington, D.C.
A PRACTICAL DETERMINATION OF LOGARITHMIC-AMPLITUDE TIME SPECTRUM UNDER ARBITRARY TURBULENCE
Walter J. Brinks 14 Jul. 1964 14 p refs
(TR-1241; AD-606702)

This report presents a method for calculating the time spectrum of the logarithmic-amplitude fluctuations of an electromagnetic wave propagating through a turbulent atmosphere, when the turbulence is a given function of position over the radiation path. Author

N64-32449 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
CLASSES OF FREQUENCIES FREE OF MUTUAL INTERFERENCE: A THEORY OF FREQUENCY ASSIGNMENTS
Nello R. Castellini 15 Apr. 1964 52 p refs
(USAELRDL-TR-2381; AD-606796)

The mutual interference chart (MIC) gives the compatibility that exists between the channels of a radio set. This property of the chart is used to determine classes of frequencies that are compatible with given transmitting or receiving frequencies. The approach is based on the elementary theory of classes. The class characterization implies a set of frequency assignments. The set may be empty or contain one or more members

depending on the allocated frequencies, the circuit, and the MIC. The general theory for obtaining these assignments is developed. Among the set of assignments is a subset that has optimal characteristics and that is relatively simple to construct. The assignment can be constructed not only to eliminate mutual interference from co-located sources, but also to control co-channel and other interference from distant sources. Author

N64-32467 Federal Aviation Agency, Atlantic City, N.J. National Aviation Facilities Experimentation Center
AIR TRAFFIC CONTROL RADAR BEACON SYSTEM 3-PULSE SIDE LOBE SUPPRESSION EXPERIMENTATION Final Report
George F. Spingler Mar. 1964 77 p
(RD-64-36)

The side-lobe-suppression omnidirectional antenna met the side-lobe coverage and netting with the directional antenna requirements. The colocation siting problems of the omnidirectional and the directional antennas were also investigated and found to be minor in nature. A number of difficulties requiring modification of the ATCBI-2 transmitter system were uncovered during the experimental testing of the 3-pulse modification kit, but the 3-pulse modification kit did effectively perform the basic requirement of generating the correct number of mode and side-lobe suppression pulses. The original side-lobe-suppression crystal diode switch failed to meet the insertion loss specification, but with the modification of the switch crystals, all specifications were met. Author

N64-32475 Naval Air Test Center, Patuxent River, Md. Weapons Systems Test Div.
RADIO NOISE AND FLIGHT TESTS OF ELECTRICAL FLASHERS FOR AIRCRAFT LIGHTS (CHANCE VOUGHT CORPORATION PART NO. L7-21-81 FLASHER) Report No. 5 (Interim), Test Item No. 3
Paul H. Ramsey 3 Jun. 1963 6 p ref
(RAE50P023; AD-448766)

Results of radio-noise specification testing of two Chance Vought L7-21-81 flashers for aircraft lights are reported. These flashers are of the all-electronic type, constructed from solid-state components. Flight testing and applications of these flashers were not investigated, since the requirements for radio interference were not met. M.P.G.

N64-32476 Pennsylvania State U., University Park Coll. of Engineering
ELECTROMAGNETIC WAVE REFLECTION FROM AN OSCILLATING, COLLISION-FREE MAGNETO-IONIC MEDIUM Scientific Report No. 211
O. E. H. Rydbeck 20 Jun. 1964 54 p refs
(Contract AF 19(628)-4014; Grant NSF G-18983)
(AFCRL-64-610; AD-606700)

A collision-free or low-collision magneto-ionic medium is easily perturbed by a driving or pumping wave, even of moderate power. Unless the pump wave is of the longitudinal mode it will generate longitudinal electron velocities as well as differential space charge densities. These quantities, as well as the transverse, pump field electron velocities, will affect the propagation of any (low power) signal or probing wave propagating through the medium, which now has oscillating and traveling electron velocity and electron density ripples. If the pump wave is of angular frequency ω_p, and that of the signal wave is ω_s, to first-order sum and difference frequency ($\omega_{\pm 1} = \omega_p \pm \omega_s$) waves are generated in the medium. It is shown that the generation of these waves, for which specific refraction laws hold, is greatly enhanced if a parametric traveling wave resonance develops in the system or if the nonlinear driving force experiences a local resonance. Under certain conditions sum and/or difference frequency waves, usually with two kinds of polarization, will radiate away from the resonance interaction region. This generation is dealt with in detail for homogeneous media, with a discontinuous boundary, and for slowly inhomogeneous ones. Author

N64-32505 Ohio State U. Research Foundation, Columbus Antenna Lab.
THE AXIAL ECHO AREA OF A PERFECTLY CONDUCTING PROLATE SPHEROID
E. M. Kennaugh and D. L. Moffatt 15 Jun. 1964 26 p refs
(Contract AF 33(615)-1318)
(Rept.-0774-1; AD-446398)

The axial echo area of a perfectly conducting prolate spheroid is derived using an impulse approximation. As a result of the analysis, the echo area versus frequency is obtained over the resonance region. Calculated results for the case of a spheroid with a 2:1 axial ratio are compared with experimental data for spheroids with major axes ranging from 0.318 to 1.59 wavelengths. Author

N64-32552 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
ARRAY THEORY PRINCIPLES APPLIED TO LOG PERIODIC DIPOLE ARRAYS
Claes T. Elfving 22 Jul. 1964 18 p ref
(Contract DA-36-039-AMC-03404(E))
(EDL-M720; AD-447261)

A technique is described whereby the radiation characteristics of a log periodic dipole array can be accurately described mathematically at any point in space using the principles of array theory and only one measured antenna pattern. This technique can be used advantageously, in digital computer programs, when knowledge of the antenna radiation patterns is required for calculating coupling between two antennas. Equations for the coupling between two antennas, and effects of the presence of various types of ground on the antenna radiation pattern are described qualitatively. Author

N64-32561 Sylvania Electronic Products, Inc., Mountain View, Calif.
THE USE OF SOLAR RADIO EMISSION FOR ANTENNA ORIENTATION
Richard D. Bauman 22 Jun. 1964 52 p refs
(Contract DA-36-039-AMC-03404(E))
(EDL-M690; AD-449379)

The sun is a readily available source of microwave radiation that can be detected by many tracking systems. Since the position of the sun is well known from optical measurements, the sun can be used as a beacon for antenna alignment. A technique for performing such an alignment is described, and operating instructions for a computer program to provide analytic tracking angles for the sun are given. Techniques for increasing the accuracy of the alignment are discussed. The theory of the sun-tracking program is presented, and a listing of the program is provided. Author

N64-32594 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
TUNABLE MILLIMETER TRAVELING-WAVE MASER AND 8-MM MASER-RADIOMETER SYSTEM Final Report, Part I

F. Arams, B. Peyton, and F. Haneman Apr. 1963 80 p refs
(Contract AF 33(600)-41743)
(Rept.-8298-1; AD-420126)

A low-noise K_a-band receiving system has been developed that offers a substantial improvement in noise factor (and minimum detectable change in noise temperature) by using a tunable traveling-wave maser and amplifier followed by a transistorized receiver–radiometer system. The K_a-band maser operates over an extremely wide tuning range (5 Gc), and has gains of 20 dB and an instantaneous bandwidth of 75 Mc. A preliminary noise figure measurement has yielded an overall maser-radiometer system noise temperature of 130° K (1.6 dB). The noise temperature of the maser is near 20° K, the remainder being second-stage (mixer, i.f.) contribution and waveguide losses. It follows that optimum system noise temperatures of 38° K are achievable using this maser. The maser uses chromium doped titania (rutile) as the active element. By employing push–pull pumping, a relatively low pump frequency, in the 4-mm band, is obtained. Author

N64-32617 Harvard U., Cambridge, Mass. Gordon Mc Kay Lab.
THE CIRCULAR LOOP ANTENNA IMMERSED IN A DISSIPATIVE MEDIUM Scientific Report No. 6
Keigo Iizuka 3 Apr. 1964 26 p refs
(Contract AF 19(604)-7262; Grant NSF G-20275)
(AFCRL-64-339; AD-603634)

Investigations were made of the radiating and circuit properties of circular loop antennas when immersed in conducting media with various loss tangents. The following quantities were experimentally examined and compared with the available theoretical results. (1) driving-point admittance Y_{in} of circular loops as a function of the circumference per wavelength, $2\pi b/\lambda = \beta b$; (2) current amplitude and phase distributions; and (3) field patterns. In each case the loss tangent $\sigma/\omega\epsilon_r\epsilon_0$ of the medium (conductivity σ, permittivity $\epsilon_r\epsilon_0$) is taken as a parameter. Author

N64-32628 General Electric Co., Syracuse, N.Y.
OPTIMUMLY SPACED ANTENNA ARRAY Scientific Report No. 1
S. L. Shih Sep. 1964 15 p refs
(Contract AF 19(628)-3842)
(AFCRL-64-728; AD-606839)

The element spacings in nonuniformly spaced antenna arrays that give the maximum gains are determined. Gains higher than those of uniformly spaced arrays are obtained. The formulations cover arrays of isotropic and directive sources. The method of solution is described, and the results of several representative cases are presented. It is found that usually the optimum spacings required for maximum gain are almost uniform. Author

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-31351 Joint Publications Research Service, Washington, D.C.
IZVESTIYA VUZov: RADIO ENGINEERING, NO. 2, 1964
22 Sep. 1964 225 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Radiotekhn. (Kiev), v. 7, no. 2, Mar.–Apr. 1964 p 131–259
(JPRS-26492; TT-64-41750) OTS: $6.00

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20. CONTRIBUTION TO THE THEORY OF MATCHING OF REGULAR WAVEGUIDES WITH DIAPHRAGMED WAVEGUIDES G. N. Rapoport and L. M. Andrushko p 200–207 ref

21. BROADBAND WAVEGUIDE POWER STABILIZER R. A. Valitov, Ye. A. Domanova, and V. T. Tsarenko p 208–215 refs (See N64-31370 23-09)

CRITICISM AND BIBLIOGRAPHY

22. REVIEW OF BOOK BY I. P. STEPANENKO "PRINCIPLES OF TRANSISTOR THEORY AND TRANSISTOR CIRCUITS" (Gosenergoizdat, 1963) p 216–217

23. ON THE SIXTIETH BIRTHDAY AND THE FORTIETH SCIENTIFIC-PEDAGOGICAL ANNIVERSARY OF THE ACTIVITY OF PROFESSOR V. N. KESSENIKH p 218–220

N64-31352 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF THE DECREASE OF BEAM CURRENT ALONG A SLOW-WAVE SYSTEM ON THE OPERATION OF BACKWARD-WAVE AND TRAVELING-WAVE TUBES

N. P. Budnikova, N. I. Sinitsyn, and V. N. Shevchik *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 1–16 refs (See N64-31351 23-09) OTS: $6.00

A linear theory of traveling wave and backward wave tubes is constructed, with allowance for the current lost along the interaction space, and an estimate is made of the maximum backward-wave tube efficiency with allowance for this effect. The data obtained are compared with the experimental results. Author

N64-31353 Joint Publications Research Service, Washington, D.C.

NOMOGRAMS FOR THE DETERMINATION OF THE MODULUS AND THE PHASE OF THE REFLECTION COEFFICIENT OF A RADIO WAVE

V. S. Panchenko *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 17-27 refs (See N64-31351 23-09) OTS: $6.00

Simple nomograms are described for the determination of the modulus and phase of the reflection coefficient of a vertically or horizontally polarized radio wave for arbitrary glancing angle, over a wide range of values of the complex dielectric constant of the medium. Author

N64-31354 Joint Publications Research Service, Washington, D.C.

NOMOGRAM FOR THE CALCULATION OF THE PARAMETERS OF A LINEAR RADIATOR ARRAY

V. Ye. Yamaykin *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 28–38 ref (See N64-31351 23-09) OTS: $6.00

A nomogram has been developed for the choice of parameters of a linear equidistant radiator array, to insure a specified direction of the maximum principal lobe (or scanning sector). The condition of uniqueness of this maximum in both the absence and presence of dispersion is obtained. Author

N64-31355 Joint Publications Research Service, Washington, D.C.

MEASUREMENT OF LOSSES OF H_{01} WAVE IN MULTIMODE WAVE-GUIDE BY THE METHOD OF SERIES OF PULSES

A. I. Kozelev and R. F. Matveyev *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 39–55 refs (See N64-31351 23-09) OTS: $6.00

A theoretical analysis of the pulse-series method of measuring the H_{01} wave losses in multimode waveguide lines is presented. From the calculations presented, it is concluded that the main criterion for the choice of pulse duration in the pulse-series method is the permissible difference between the maximal and minimal losses. This conclusion indicates that it would be desirable to shorten the pulse as much as possible. P.V.E.

N64-31356 Joint Publications Research Service, Washington, D.C.

CALCULATION OF CYLINDRICAL INHOMOGENEITY IN A WAVEGUIDE

Yu. P. Radin *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 56–64 refs (See N64-31351 23-09) OTS: $6.00

The inhomogeneity introduced by a dielectric post in a rectangular waveguide is analyzed. In the limiting case, the result obtained is valid for a metallic post. Experimental data on the measurement of the dielectric constant of several substances, using the results obtained in the paper, are given. Author

N64-31357 Joint Publications Research Service, Washington, D.C.

EXCITATION OF SURFACE WAVES BY A DISCRETELY DISTRIBUTED NON-PROJECTING SOURCE

M. S. Bobrovnikov, V. L. Mironov, and V. P. Smirnov *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 65–78 refs (See N64-31351 23-09) OTS: $6.00

The problem is solved of exciting surface electromagnetic waves on an unbounded impedance plane by a discretely distributed nonprojecting source in the form of a system of nonphased filaments of magnetic current, located on the impedance plane itself, for arbitrary distance between filaments. It is shown for the case $n = 2$ that under certain conditions the efficiency of excitation of surface waves is larger in such a source than in a concentrated source. The source under consideration makes it possible to realize directed excitation of surface waves. Author

N64-31358 Joint Publications Research Service, Washington, D.C.

ON THE CALCULATION OF COMPOSITE OSCILLATING SYSTEMS

B. I. Kurilin *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 79–87 refs (See N64-31351 23-09) OTS: $6.00

The relations necessary for the calculation of a system consisting of several segments of a long line treated as a resonant circuit are derived. Author

N64-31359 Joint Publications Research Service, Washington, D.C.

CHARACTERISTICS OF SOME FERRITE PHASE SHIFTERS FOR THE CENTIMETER BAND

I. M. Grankin and Yu. F. Larkin *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 88–96 refs (See N64-31351 23-09) OTS: $6.00

The constructions of four types of nonreciprocal ferrite phase shifters are considered and experimental data are given in the 8300 to 9800 Mc band. Methods of reducing the dispersion of the relative phase shift are shown. Author

N64-31360 Joint Publications Research Service, Washington, D.C.
EFFECT OF THE FILLING FACTOR OF THE DRIFT CHANNEL ON THE EFFICIENCY OF A TRAVELING WAVE TUBE
V. I. Shevchenko and V. V. Murav'yev *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 97–113 refs (See N64-31351 23-09) OTS: $6.00

Considered is the variation in the efficiency of a traveling wave tube with increase in the reduced radius of the beam at a constant radius of the drift channel and with the broadening of the channel. An estimate is made of the traveling wave tube efficiency when a tubular electron beam is used. Author

N64-31361 Joint Publications Research Service, Washington, D.C.
PROCEDURE FOR MEASURING THE COUPLING RESISTANCE OF SLOW-WAVE SYSTEMS BY A DIELECTRIC PROBE
K. Ya. Lizhdvoy *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 114–121 refs (See N64-31351 22-09) OTS: $6.00

A procedure is considered for measuring the coupling resistance of periodic slow-wave systems by the dielectric probe method. A formula is obtained for calculating the coupling resistance of the first positive spatial harmonic in the pass band of the system by means of measurement at a single point. Author

N64-31362 Joint Publications Research Service, Washington, D.C.
DIAGRAMS OF THE PARAMETERS OF RESONANT AMPLIFIERS
E. M. Guttsayt *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 122–132 refs (See N64-31351 23-09) OTS: $6.00

Diagrams are plotted for constant efficiencies of resonant systems, amplification coefficients, relative working bandwidths, and products of the bandwidths by the voltage gains, with coordinates that include the intensity of the coupling of resonant systems with external loads and the activity of the amplifying medium. The diagrams cover the main modes of resonant two-port and one-port amplifiers, and are of practical interest for the derivation and calculation of parameters of regenerative amplifiers. Author

N64-31363 Joint Publications Research Service, Washington, D.C.
DESIGN OF A JOINT OF MULTIMODE RECTANGULAR WAVEGUIDES
V. S. Buryak *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 133–144 refs (See N64-31351 23-09) OTS: $6.00

General formulas are presented for the determination of the electromagnetic field in the region of a joint of rectangular waveguides having the same height, permitting the existence of higher modes. Author

N64-31364 Joint Publications Research Service, Washington, D.C.
OBTAINING A LOGARITHMIC AMPLITUDE RESPONSE CURVE IN A TRANSISTORIZED VIDEO AMPLIFIER
V. V. Sidorenko and V. M. Volkov *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 145–160 ref (See N64-31351 23-09) OTS: $6.00

The possibility is considered of obtaining a logarithmic amplitude response curve in a transistorized video amplifier by shunting the collector load of the stage with a nonlinear divider. The law that governs the variation of the resistance of the nonlinear element is determined. The results of an experimental investigation are reported. Author

N64-31365 Joint Publications Research Service, Washington, D.C.
THEORY OF TWO-STAGE TRANSISTOR AMPLIFIER WITH PARALLEL FEEDBACK
V. A. Gantsev *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 161–173 refs (See N64-31351 23-09) OTS: $6.00

An analysis is presented of the transient characteristics of a two-stage transistor amplifier with parallel feedback in the aperiodic, critical, and oscillatory modes. In the critical mode, the condition for obtaining maximum depth of feedback is determined. The sequence of the calculation is presented. Author

N64-31366 Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF ELECTROMECHANICAL TRANSMISSION-TYPE CONVERTERS
A. S. Pizio *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 174–179 refs (See N64-31351 23-09) OTS: $6.00

Methods are considered for describing the properties of electromechanical transmission-type converters by means of linear equations and equivalent circuits, analogous to the methods used to describe the properties of transmission-type two-ports, but with allowance for the peculiarities of the devices under consideration. Author

N64-31367 Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL INVESTIGATION OF THE FREQUENCY DEPENDENCE OF THE MAGNETIZING CURRENT OF A CIRCULATOR
G. P. Veselkov *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 180–184 ref (See N64-31351 23-09) OTS: $6.00

The experimental investigation of the cylindrical waveguide with ferrite rods has shown the promising nature of the method based on a joint utilization of a compensation construction and of a dielectric sleeve placed on one of the ferrite rods, using weak external fields. The construction described makes it possible to maintain automatically the rotation angle of the polarization plane of the wave at a level of 45° within a frequency band exceeding 34%. The operating frequency band can be broadened further by developing especially for this purpose other sections of the channel (detector sections, transitions from the round waveguide to the rectangular waveguide, etc.) if a deviation of ±3° from 45° is permissible. Author

N64-31369 Joint Publications Research Service, Washington, D.C.
ON THE DESIGN OF MICROWAVE TUBES WITH TUBULAR BEAMS

N. Ye. Belov *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 191–194 refs (See N64-31351 23-09) OTS: $6.00

In the design of microwave tubes with tubular beams of charge particles, it is necessary to calculate the main parameters. This is effected by first solving dispersion equations and expanding the Bessel functions of the arguments, thus arriving at a simplified equation that enables one to determine the first three roots of the dispersion equation and by expanding in powers of the the reciprocal functions, to determine higher order roots. A.W.

N64-31370 Joint Publications Research Service, Washington, D.C.

BROADBAND WAVEGUIDE POWER STABILIZER

R. A. Valitov, Ye. A. Domanova, and V. T. Tsarenko *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 208–213 refs (See N64-31351 23-09) OTS: $6.00

The paper describes a stabilizer able to maintain constant power in a load accurate to several percent in a frequency band of 20%. The stabilizer is made broadband by using, as the actuating element of the regulator, an electrically controlled attenuator made of a germanium slab with rectifying n-p function, and by using a gas-discharge section as the input-measuring element. A.W.

N64-31403 New Hampshire U., Durham

DESIGNING DC-DC CONVERTERS FOR HIGH EFFICIENCY AT LOW POWER Scientific Report No. 2

John A. Higgins and James H. Trainor (M.S. Thesis) Jun. 1964 61 p refs

(Contract AF 19(628)-2352)

(AFCRL-64-558; AD-606312)

The purpose of this study was to investigate, design, and fabricate miniature dc-dc converters that would meet satellite and rocket environmental conditions. The objective was to develop a general procedure to be followed in the design of low-power voltage stepdown converters, the primary concern being that of maximum efficiency. The effort was divided into three major areas of study: (1) the transistor or switch, (2) the transformer, and (3) the remaining circuitry. In addition to the development of a general design procedure for miniature dc-dc converters, a 28-12 V, 1.5-W unit with better than 85% efficiency was achieved. Author

N64-31493 General Precision, Inc., Little Falls, N.J. Kearfott Div.

SOLID STATE SYNCHRO CONVERSION DEVICES

John Brinkman *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 255–272 (See N64-31476 23-17) OTS: $9.40

With the advent of central digital computers in weapons control, guidance, and data systems, the need for a link between numerous types of analog sensors and the central digital computer has been apparent. This paper describes briefly two converters, a synchro-to-digital converter and a digital-to-synchro converter. These units provide the "link" between typical synchros in a system and an associated digital computer. The paper also discusses briefly the conversion techniques used and relates these techniques to the more common techniques of dc voltage-to-digital and digital-to-dc voltage conversion. Author

N64-31494 Computer Control Co., Inc., Framingham, Mass.

MICROELECTRONIC DIGITAL STABILIZATION COMPUTER

David Hartig *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 273–291 (See N64-31476 23-17) OTS: $9.40

A digital stabilization computer constructed from microelectronic components is described. The device will resolve input target coordinate data through roll, pitch, and heading angles to produce train and elevation orders in the deck plane, or the reverse operation; deck reference quantities to a horizontally referenced plane. This operation can be performed 1000 times per second on either or both of two channels while full 15-bit computational accuracy is maintained. Input can be from a computer, and/or two radars, whereas output may be either a computer and/or two gun or launcher drives. P.V.E.

N64-31495 General Precision, Inc., Glendale, Calif.

SYNCHRO-TO-DIGITAL CONVERTER

Roy Y. Kakuda *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 292–302 (See N64-31476 23-17) OTS: $9.40

A developmental converter system that decodes double-speed synchro information into a decimal readout is described. The system operation is discussed, and a detailed description of the circuitry involved is presented. The conversion accuracy is 6 minutes with a dead band (the band where the system triggers going in either direction) of less than 1.2 minutes. The converter is insensitive to relatively high noise levels, phase (with negligible effects by frequency), and reference amplitude variations. P.V.E.

N64-31496 Naval Avionics Facility, Indianapolis, Ind.

A UNIQUE POWER AMPLIFIER

Robert R. Atherton *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 303–308 (See N64-31476 23-17) OTS: $9.40

The design of a 30-watt servoamplifier may be accomplished by using an existing 10-watt amplifier as a driver unit. The output of the 10-watt amplifier is coupled to an emitter-follower circuit, which, in turn, drives the 30-watt load. Since the emitter-follower is essentially a unity voltage-gain amplifier, the characteristics of the 30-watt system, such as input impedance, linearity, voltage gain, gain stability, etc., duplicate those of the 10-watt amplifier. However, the 10-watt driver amplifier works at only a fraction of its full-load capability, and the emitter-follower must deliver the entire load power. The proportioning of the load current between the driver and output stages is accomplished with a small transformer. Both the driver amplifier and the power-proportioning module employ push–pull circuitry. P.V.E.

N64-31497 United Aircraft Corp., Norwalk, Conn. Norden Div.

MICROELECTRONIC PRECISION ANALOG AMPLIFIERS

M. W. Aarons, J. E. Jennings, and R. E. Lovelace *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1962 p 309–344 (See N64-31476 23-17) OTS: $9.40

A set of rules and morphological algorithms that permit rapid design of microelectronic amplifiers with the assistance of a digital computer were used to design four microelectronic amplifiers. The four amplifiers, described in some detail, are these: a 6-watt amplifier, a 2-stage differential amplifier, a 2-strobe sense amplifier, and a 1-strobe sense amplifier. P.V.E.

N64-31498 National Bureau of Standards, Washington, D.C.
STANDARDIZATION OF DEFINITIONS FOR HALL EFFECT DEVICES
S. Rubin *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 344–361 refs (See N64-31476 23-17) OTS: $9.40

A characterization of Hall generators is presented along with a brief discussion of galvanomagnetic effects. The characterization is discussed with respect to the following: standard terminology, sensitivity, control current, linearity error, reversibility, and zero-field voltage. P.V.E.

N64-31501 Naval Ordnance Lab., White Oak, Md. Advanced Engineering Div.
RF INSENSITIVE PNPN SWITCH
R. J. Sanford and A. J. Cote, Jr. *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 399–408 (See N64-31476 23-17) OTS: $9.40

A desirable method of keeping stray electromagnetic energy from reaching critical arming and fuzing circuits of weapons is to develop components in which the filtering of unwanted rf signals is inherently carried out. A prototype controlled switch that operates normally in response to triggering pulses, but is insensitive to rf signals, is discussed. The device is essentially a simple microelectronic semiconductor circuit in which the principal component is a controlled rectifier. P.V.E.

N64-31503 Reeves Instrument Corp., Garden City, N.Y.
A BRUSHLESS PHASE SHIFTING DEVICE
Don Rosenberg *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 449–456 (See N64-31476 23-17) OTS: $9.40

A novel phase-shifting device is described. The device differs from other electromagnetic phase shifters in that all brushes and slip rings have been eliminated. The elimination of brushes provides complete freedom from the electrical noise and disturbances that are due to sliding electrical contact. Other advantages include increased reliability, long life, and capability of high rotational speeds. Basically, the brushless phase shifter comprises two short stack resolver stators inductively isolated one from the other, and a full-length resolver rotor assembly inductively coupled to both stators. The time phase of a voltage applied to one stator, relative to the voltage induced into the second stator, is a function of the angular position of the common rotor coupling the two stators. The brushless phase shift concept can be utilized over a broad range of frequencies, depending upon the particular design parameters chosen. The accuracy of the devices is within ±15 minutes of arc at room temperature. P.V.E.

N64-31617 MacLeod Instrument Corp., Fort Lauderdale, Fla.
DIGITAL SELECTOR SWITCH Monthly Progress Report
Maurice Lefka 15 May 1964 14 p
(Contract DA-01-009-AMC-87(A))
(MPR-6; AD-447842)

No switch failures or changes in operating characteristics were recorded during high- and low-temperature tests of glass reed-type switches. All switches operated without malfunction during a preliminary vibration test. Various packaging concepts were investigated, and feasibility models were fabricated. The most promising model consists of mounting a permanent magnet to a tape loop. The tape serves the dual function of transporting the magnet to the appropriate switch and providing a visual indication of the time set-in by viewing a number inscribed on the tape. This concept readily lends itself to push-button position selection. R.L.K.

N64-31684 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURES: TRANSISTOR RELIABILITY Final Engineering Report, May 1, 1962-Dec. 31, 1963
James T. Lineback et al 3 Mar. 1964 114 p
(Contract DA-36-093-SC-86730)
(Rept.-03-64-12; AD-601956)

Process improvement work and reliability testing were performed. Improvements were installed throughout the process to gain better control on manufacturing steps, and to reduce operator dependency. Acceptance criteria for both manufacturing and quality control inspection operations have been more specifically defined and tightened. Reliability testing on a total of 2200 transistor at three power levels—one, one and one-half, and twice maximum rated power—has shown an extrapolated failure rate that is less than 0.01% per 1000 hours at 25° C with a 90% confidence level. Author

N64-31691 Radio Corp. of America, Harrison, N.J. Electron Tube Div.
AN L-BAND TUNNEL DIODE OSCILLATOR Quarterly Progress Report No. 4, 1 Mar.–31 May 1963
D. E. Nelson, R. Gold, and E. T. Casterline [1963] 20 p
(Contract DA-36-039-SC-90773)
(Rept.-4; AD-421867)

Recent developments in crystal-growing techniques were employed to grow two highly doped gallium-arsenide crystals. Both crystals have produced satisfactory tunnel diodes. Tunnel diodes were made having a ring junction geometry. Although the process worked well, the electrical parameters were not as good as hoped for, possibly due to a different alloying schedule. A new tunable oscillator circuit was made and tested. A power output of 26 to 30 MW was obtained over the required frequency range. Author

N64-31692 SFD Labs., Inc., Union, N.J.
THE LARMOTRON: A TRANSVERSE WAVE AMPLIFIER Final Report, Feb. 1961–May 1963
G. Bernstein, J. Feinstein, and W. C. Sylvernal Wright-Patterson AFB, Ohio, ASD, Jul. 1963 40 p refs
(Contract AF 33(616)-8030)
(ASD-TDR-63-765; AD-420146)

Nine amplifier tubes have been built. Gains of over 10 db have been achieved. The characteristics of two alternate forms of dc pumping have been explored, as well as the possibility of achieving gain by electron-beam interaction with a continuous length of slow-wave circuit. Two major limiting problems arose in the course of this investigation. One was the "blow up" of electron-beam diameter, which occurred when dc pumping was applied to the beam. The other problem was concerned with the difficulty of achieving pure transverse wave modulation of the beam when using a slow wave rf circuit. The details of these problems are presented and conclusions are drawn. Author

N64-31697 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATIONS FOR NONLINEAR AUTOMATIC SYSTEMS

I. I. Krinetskiy 12 Aug. 1963 234 p refs Transl. into ENGLISH from the book "Raschet Nelineynykh Avtomaticheskikh Sistem" Kiev, Gos. Izd. Tekhn. Lit. USSR, 1962 p 1–225
(FTD-TT-63-125/1+2; AD-421509)

Approximate methods for the calculation of free and forced oscillations of nonlinear automatic systems are presented in accordance with automatic-control theory. M.P.G.

N64-31701 General Atronics Corp., Philadelphia, Pa. Electronic Tube and Instrument Div.
DESIGN, DEVELOP AND FABRICATE MINIATURE, FIBER OPTIC FACEPLATE CATHODE RAY TUBES. Quarterly Progress Report, May–Jul. 1963
Robert C. Hilliard, Guy Barnett, Robert S. Moore, and Sam Pearlman [1963] 40 p
(Contract NObsr-89280)
(QPR-1; AD-420252)

Work was done in the principal areas of phosphor evaluation, gun design, and electron optics. Preliminary guns have been constructed, tested, and evaluated. Gun computations and design have been completed, and the new assemblies have been fabricated for further test and evaluation. Phosphor samples have been studied. A bell-jar vacuum system has been installed for the study of electron optics. Components for the electron optics are being designed and manufactured. Spray apparatus has been set up for producing conductive films on glass substrates prior to phosphor deposition. Author

N64-31702 George Washington U., Washington, D.C. Human Resources Research Office
EVALUATION OF AN AUTO-INSTRUCTIONAL PROGRAM ON THE FIRST WEEK OF A BASIC ELECTRONICS COURSE
William H. Melching, Harold E. Christensen, and Albert L. Kubala Mar. 1964 82 p
(Contract DA-44-188-ARO-2)
(AD-601681)

Several factors pertaining to the experimental setup complicated the presentation of clear-cut conclusions. However, results indicated that programed instruction produced better performance when complete self-pacing was employed than when only limited self-pacing was permitted. An increase in amount of time available to study the program led to an increase in the number of students achieving an arbitrary passing level of performance. The program did not materially compensate for inadequate educational backgrounds; low-aptitude students did not achieve satisfactory levels of performance; this may have been due to inadequate pretesting. R.L.K.

N64-31719* Hayes International Corp., Birmingham, Ala. Missile and Space Support Div.
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES ELECTRONIC EQUIPMENT PACKAGING FOR A LUNAR MOBILE LABORATORY
J.W. Lombard Huntsville, Ala., NASA. Marshall Space Flight Center, Oct. 1964 42 p
(Contract NAS8-5307)
(NASA-CR-61019) OTS: $2.00 fs; $0.50 mf

This report presents the temperature limitations of the types of components that could be used in a Lunar Mobile Laboratory (MOLAB), and compares these temperature limits with the MOLAB-mission temperatures. A list of the basic components that could be used to make up the required electronic units is included, and the nonoperating temperature limits of these components are tabulated. A comparison is made of the nonoperating temperature limits of the components with the MOLAB-mission temperatures. A discussion is presented of the factors that will affect the operating temperatures of the components; the relationship of these factors with the MOLAB-mission temperatures is also discussed. Author

N64-31732* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNIQUE FOR SYNTHESIS OF CONSTANT LINEAR DYNAMICAL SYSTEMS WITH A BANG-BANG CONTROLLER
Jerrold H. Suddath and Terrance M. Carney Washington, NASA, Aug. 1964 35 p refs
(NASA-TR-R-200) OTS: $1.00

A theoretical study was made to determine the utility of a technique for the synthesis of constant linear dynamical systems with a bang-bang controller. The technique employs linear switching logic and the premise that the use of time-dependent gains eliminates endpoints. Conditions for asymptotic stability were obtained from consideration of Liapunov functions. As part of the investigation, the technique was applied in an analog computer simulation of an idealized attitude-control system for spinning space vehicles. The system was idealized in the sense that the equations of motion were linearized and time lags in control-system components were neglected. The analog simulation demonstrated the stability and flexibility of the closed-loop control logic under a variety of conditions, and no end points were encountered. Author

N64-31771 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE QUESTION OF CIRCUIT DIAGRAMS OF ASPIRATION CONDENSERS IN ION-COUNTERS
Kh. F. Tammet *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 102–106 refs (See N64-31758 23-21)

Methods of compensating the instability of voltage of power source by means of special circuits are reviewed. Author

N64-31807 Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
MEASUREMENT OF NOISE FIGURE OF AN X-BAND WAVEGUIDE MIXER WITH TUNNEL DIODE Physical Sciences Research Papers No. 32
Gustav H. Blaeser Jul. 1964 17 p refs
(AFCRL-64-547; AD-605812)

Noise-figure measurements of an X-band tunnel diode mixer must be carried out with extreme care, since spurious responses can often produce incorrect results. At microwave frequencies, a waveguide system with a plunger at one side of the diode is used, and it is important that one terminal of the diode be isolated from the waveguide wall when the bias voltage is applied. The output of the mixer containing the difference frequency is connected to the input of an amplifier with a series combination of bias components. This series combination contains additional inductance and capacitance other than that of the 30 Mc/sec amplifier and can produce resonance effects when the tunnel diode is operated in the positive region close to the peak current, thereby leading to an error in the noise-figure measurement. Correct and incorrect noise figures are compared. Author

N64-31852 Joint Publications Research Service, Washington, D.C.
ERRORS IN A STATIC TRANSFORMER OF ACTIVE VOLTAGE (TYPE CB π A-1) BECAUSE OF THE DISTORTIONS IN THE FORM OF THE CURRENT VOLTAGE AND CURVE

A. I. Fremke and O. S. Shvegdza *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 1–6 refs (See N64-31851 23-15) OTS: $5.00

Errors in the power output of a transformer that result from distortions in the form of the voltage and current curves are examined. From the results obtained in the examination, the following deductions are made: (1) Transformer output voltages depend on the value of the amplitude and the angles of shift of the harmonics in the curves of the current and voltage. (2) When distortions occur only in the current, then the errors are shifted in the direction of positive errors. (3) The amount of error increases with an increase in the current. P.V.E.

N64-31857 Joint Publications Research Service, Washington, D.C.

CONCERNING SYNTHESIS OF SYSTEMS WITH VARIABLE PARAMETERS, WHICH IS ACHIEVED BY MEANS OF "FROZEN" WEIGHT FUNCTION

G. I. Vanyuikhin *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 39–45 refs (See N64-31851 23-15) OTS: $5.00

In order to secure an approximate solution of the problem of synthesis of the system, containing a link with variable parameters, the weight function of this link is "frozen" at a certain moment of time t_0, which in effect reduces the system to a stationary one. It is demonstrated that such procedure has definite advantages over the method of "frozen" coefficients. Author

N64-31858 Joint Publications Research Service, Washington, D.C.

REGARDING THE PARAMETERS OF NON-LINEAR ACTIVE RESISTANCES ON THE DIRECT CURRENT

V. V. Sokolov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 46–53 refs (See N64-31851 23-15) OTS: $5.00

Examined are problems of polyvalence and intermittent currents of static volt–ampere characteristic noncomponent, nonlinear active resistances. Mathematic deduction and physical interpretation are offered regarding the values characterizing inertia and static resistance of the element. Author

N64-31859 Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL INVESTIGATION OF LOW CAPACITY STEP-BY-STEP MOTORS

Sh. Yu. Ismailov, A. M. Smolyarov, and B. I. Levkoyev *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 54–59 refs (See N64-31851 23-15) OTS: $5.00

The results of experimental investigations of low capacity step-by-step motors are reported from the point of view of their application as acting elements of instruments and systems of automation. Author

N64-31861 Joint Publications Research Service, Washington, D.C.

MULTICYCLED SHIFT REGISTER WITH FERRITE TRANSISTOR CELLS

A. M. Kayumov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 68–71 refs (See N64-31851 23-15) OTS: $5.00

This article is devoted to the problem of reducing the number of ferrite-transistor cells in shift registers by changing them from two to multiple cycles. A relationship is worked out between the categories of numerals in the register, number of its cycles, number of cells, and time required. Also the method is proposed for selection of the optimum type register. Author

N64-31869 Joint Publications Research Service, Washington, D.C.

CONCERNING THERMAL CONDITIONS OF THE MULTI-BLOCK RADIO-ELECTRONIC DEVICES

G. N. Dul'nev and A. I. Kaydanov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 121–128 refs (See N64-31851 23-15) OTS: $5.00

Discussed are certain general principles and possible methods of examination of the thermal conditions of radio-electronic devices of complex construction characteristics. A comparison and an exemplary evaluation is given of these methods and of the possibilities they offer. Author

N64-31892 Raytheon Co., Burlington, Mass. Spencer Lab.

DEVELOPMENT OF TPOMI-TYPE 10 MW L-BAND FORWARD-WAVE AMPLIFIER Final Report QK751

Robert E. Edwards 17 Aug. 1964 237 p refs
(Contract AF 30(602)-1830)
(PT-470; RADC-TDR-62-383; AD-605715)

Microwave tubes of the TPOMI class are pulsed-typed rf amplifiers that combine the fundamental electronic interaction properties of the magnetron with the injected beam and continuous interaction principles of the conventional "O"-type traveling-wave tube. Principles of operation and advantages of the tube type are discussed. The state-of-the-art for crossed-field amplifiers was advanced by the program to include 10-MW amplifiers. Problem areas included the establishing of optimum delay line and sole designs, the reduction of sparking or breakdowns, the improvement of signal-to-noise ratio and the diminishment of the radiation of rf energy in undesired rapid modes. Significant discoveries in these areas are discussed. The required 10-MW peak-power level was attained in the QK751 tube with a gain of 14 to 16 dB, an efficiency of 40% to 50%, and a bandwidth capability of 1220 to 1380 Mc/sec. D.E.W.

N64-31919 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering

VARACTOR FREQUENCY MODULATION OF THE SUPPORTED DRIFT TUBE KLYSTRON

Richard A. Northrup (M.S. Thesis) Aug. 1963 68 p refs
(GE/EE/63-20; AD-420593)

This report explores the feasibility of frequency modulating an S-band two-cavity klystron by means of a varactor coupled to the oscillator cavity. Capacitance relationships, resistance, figures of merit, and the equivalent circuit of the varactor are presented along with varactor selection and modulation circuit design. Frequency and modulation measurement techniques are developed. Static and modulation tests are performed with two varactor types at two degrees of coupling. Data include frequency deviations, power reductions, nonlinearity, and optimum bias points. An rf-induced varactor current phenomenon is observed and discussed. Results indicate possible utilization of this method of modulation. Author

N64-31996 Radio Corp. of America, Princeton, N.J. RCA Labs.
INTEGRATED LOGIC NETS Final Report, Jul. 1, 1961–Jun. 30, 1964
A. K. Rapp and R. S. Silver 31 Jul. 1964 20 p
(Contract AF 19(604)-8836)
(AFCRL-64-649; AD-605731)

Investigations into suitable devices for constructing integrated logic nets led to the development of the MOS (metal-oxide-semiconductor) transistor. Success in its fabrication was realized through extensions of the well-established diffusion and photolithographic techniques used for bipolar-transistor construction. Analysis of the MOS structure has produced a mathematical model that is useful for both optimizing device parameters and calculating circuit performance. Electrical instabilities, which initially were observed in MOS transistors, were shown to be not fundamental to the device; alteration of the fabrication process resulted in transistors that exhibited no signs of instability during a 300-hour test period. Recent theoretical and empirical analysis of transistor properties has clarified and confirmed the role played by transistor geometry. In addition, substrate bias voltage was shown to be of value both for increasing pinch-off voltage and for reducing average drain capacitance. Author

N64-32006 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
FLEXIBLE DIGITAL ANALOGUE CONVERTER FOR THE CONTROL OF THE "ON LINE" EXPERIMENT [CONVERTITORE DIGITALE ANALOGICO FLESSIBILE PER IL CONTROLLO DI ESPERIENZE "ON LINE"]
B. Bertolucci and M. Coli 27 Jul. 1964 15 p refs In ITALIAN
/ts Nota Interna No. 255
(LNF-64/40)

Circuitry for an analog-to-digital converter for real-time reduction of multiparameter data in nuclear physics experiments is described. Trans. by P.F.E.

N64-32036 Thermo Electron Engineering Corp., Waltham, Mass.
ADDITIVE CONVERTER STUDIES Second Quarterly Report
A. L. Hyland Jun. 1963 23 p
(Contract AF 33(657)-10130)
(Rept.-36-63; AD-406926)

The bare work function of the rhenium emitter as calculated from Richardson's equation is presented graphically, and representative cesium data from the additive converter are plotted on copies of previous rhenium emitter–molybdenum collector data. The additive converter cesium data agree closely with previously obtained information. Data were also gathered on the effect of the additive on the work functions of the emitter and the collector. Construction of parts for corrosion test vehicles is reported. D.E.W.

N64-32169 Mac Leod Instrument Corp., Fort Lauderdale, Fla.
DIGITAL SELECTOR SWITCH Monthly Progress Report No. 5, 1–31 Mar. 1964
Maurice Lefka 15 Apr. 1964 16 p
(Contract DA-01-009-AMC-87(A))
(AD-447841)

Progress in the design and development of a digital selector switch capable of switching any combination of 40 circuits is summarized. The digital selector switch will function as a time setting for an electronic timer and will permit time selection from 0.1 to 999.9 seconds. An engineering survey indicated that glass reed-type switches are suited for this application. The first design considerations were concerned with determining the ideal switch sensitivity, permanent magnet strength, and minimum allowable spacing between adjacent switches. Work on construction of environmental test modules is continuing. Fifteen test modules are completed and ready for environmental vibration testing. The most promising feasibility model fabricated consisted of mounting a permanent magnet to a tape loop. The tape serves the dual function of transporting the magnet to the appropriate switch, and provides a visual indication of the timer set-in by viewing a number inscribed on the tape. P.V.E.

N64-32172 Radio Corp. of America, Camden, N.J. Space Communications Div.
MICRO-MODULE PRODUCTION PROGRAM Quarterly Report, Apr. 1–Jul. 1, 1963
[1963] 70 p
(Contract DA-36-039-SC-75968)
(QR-21; AD-421496)

Production and testing status at the various industrial participants in the Micro-Module Program is discussed. The micromodule concept involves using elements with standardized dimensions of 0.31 × 0.31 × 0.1 in., which can be stacked in accordance with the pertinent circuit function and encapsulated into micromodules. By efficient grouping of micromodules into compact subassemblies and equipments, a component density of 600 000 parts/ft^3 is anticipated. The following are included in the program: capacitors, resistors, inductors, transistors, diodes, diode mounting and micromodule assembly, and assembly and testing of a micropac computer. M.P.G.

N64-32207 Bell Telephone Labs., Inc., Murray Hill, N.J.
ENGINEERING SERVICES ON TRANSISTORS Fourth Quarterly Progress Report, 1 Jan. 31 Mar. 1964
C. R. Crowell, D. Kahng, J. Kocsis, M. P. Lepselter, K. E. Martersteck et al 30 Jun. 1964 43 p refs
(Contract DA-36-039-AMC-02227(E))
(Rept.-16; AD-603355)

Status of the work on a 6-Gc low-power germanium transistor is reported. Techniques for fabricating the oxide-photoengraved planar structure are evaluated. Results of a computer analysis of effects of header parasitic impedances are presented. Photoelectric measurements of the bias dependence of the potential energy barrier for electrons in gold n-type silicon Schottky diodes show that the value of the image force dielectric constant deduced from direct measurement of the barrier lowering is 12.0 ±0.5, in close agreement with the infrared dielectric constant of silicon, and independent of the applied field for fields between 10^4 V/cm and 2×10^5 V/cm. Silicon resistors have been aged 1000 hours at 350° C. Values remained within about 1% of initial values. Author

N64-32210 General Electric Co., Ithaca, N.Y. Electronics Lab.
AUTOMATIC RECOVERY FROM TRANSIENT MALFUNCTIONS IN SPACE COMPUTERS Final Report, Jul. 1963–Jul. 1964
Wright-Patterson AFB, Ohio. AF Avionics Lab., Aug. 1964 83 p refs
(Contract AF 04(695)-319)
(AL-TDR-64-142; AD-604064)

The feasibility of improving the reliability of spaceborne computers by automatic recovery from transient malfunctions was investigated. The principal conclusion is that management

of the transient malfunctions that may occur within a digital computer by self-contained means is both feasible and practical. Techniques for the detection of malfunctions and for automatic recovery are presented. Author

N64-32222 Sperry Gyroscope Co., Great Neck, N.Y. Electronic Tube Div.
APPLIED RESEARCH ON A HIGH-POWER V-BAND AMPLIFIER Final Engineering Report, 1 May 1961–30 Sep. 1963
Wright-Patterson AFB, Ohio, AF Avionics Lab., [1963] 108 p
(Contract AF 33(616)-8292)
(NA-8220-8367; AL-TDR-64-203; AD-605526)

The applied research on a high power V-band 55-Gc amplifier chain resulted in the design of a CW 1-W, 30-dB amplifier traveling wave tube. Design studies were performed toward a 50-kW high gain, broadband traveling wave amplifier. Author

N64-32271 Sperry Rand Research Center, Sudbury, Mass.
A STUDY ON P-N JUNCTION PHOTODETECTORS UTILIZING INTERNAL PARAMETRIC AMPLIFICATION First Quarterly Report, 1 Apr.–30 Jun. 1964
David E. Sawyer [1964] 5 p refs
(Contract N600(19)-61770)
(SRRC-RR-64-49; AD-447444)

Circuit analysis of photoparametric diodes has been carried out using several device-doping distributions. A p-i-n-n^+ (or alternately, n-i-p-p^+) structure is proposed for operation in the microwave region. One requirement of diodes for photoparametric operation is that they have a high Q at the signal frequency and at the quiescent bias point. Germanium photodiodes with RC cutoff frequencies above 23.0 Gc and saturation currents low enough for microwave operation have been fabricated. For accurate junction-depth measurements, a sensitive depth gage reading to 0.2 microns was obtained. Also, construction of a photoscanning apparatus has begun. P.V.E.

N64-32272 Centre de Physique Electronique et Corpusculaire, Orsay (France)
GENERATION OF INFRAMILLIMETRIC WAVES BY MEANS OF ELECTRONIC BEAMS Interim Technical Report No. 3, 1 Jan.–31 Mar. 1964
[1964] 30 p
(Contract AF 61(052)-715)
(WR-1213; RADC-TDR-64-351; AD-603183)

Electromagnetic oscillations with a wavelength of 0.38 mm were produced, and the equipment is described. Areas for improvement are mentioned, and solution of these problems is forecast. Future plans are outlined. D.E.W.

N64-32280 Air Force Systems Command, Kirtland AFB, N. Mex.
TECHNIQUES FOR ELECTRICAL SWITCHING NEAR THE REACTOR OF A NUCLEAR POWERED CARRIER
Edwin C. Hollinger Aug. 1963 64 p refs
(RTD-TDR-63-3062; AD-422064)

Generation of sustained high temperature, neutron flux, and gamma radiation under the low-pressure atmospheric conditions of near space demands a special selection of materials and techniques to accomplish electromechanical switching in the environment. Since minimum shield conditions exist, control of switching must be performed remotely. When the load requirement includes high current and/or multiple switching of many circuits, the implied cable weight suggests that switching be done in the environment by a slaved device controlled from a remote point. This report cites the findings of an AF task directed to general solutions for problems found in a high-current, multiple-circuit switching requirement where the switch package operates at 300° F in a combined neutron and gamma radiation field. Author

N64-32346 Portugal Nuclear Energy Commission, Sacavem Div. of Electronic Physics
ON A SINGLE JUNCTION TRANSISTOR AS A FREQUENCY CONVERTER [O TRANSISTOR UNIJUNCAO COMO CONVERSOR DE CORRENTE EM FREQUENCIA]
A. G. Toscano Rico 22 Jul. 1964 24 p refs In PORTUGUESE; FRENCH summary
(LFEN-NI.13(α))

The characteristics of a unijunction transistor permit its use in current-frequency conversion. Considerations are given concerning the form of the characteristics of conversion and its linearity. A converter receiving the current from an ionization chamber is studied. Trans. by M.P.G.

N64-32362 Datametrics Corp., North Hollywood, Calif.
STUDY OF UNPOWERED PERSONAL TRANSMITTER TECHNIQUES Research Contract Status Report, 1 Feb.–1 Mar. 1964
2 Mar. 1964 44 p
(Contract AF 33(615)-1130)
(AD-439830)

An analytical examination of the oscillator buildup-time characteristic, and the ultimate determination of an expression for transmitter bandwidth in terms of important circuit parameters are discussed. A detailed derivation of the bandwidth expression is presented. In the derivation, the basic transmitter circuitry was considered to be comprised of Hartley crystal oscillators. P.V.E.

N64-32421 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
THERMAL SHOCK STRESS PROBLEMS WITH CONFORMAL COATED PRINTED CIRCUIT ASSEMBLIES
Charles E. Riley and Kenneth W. Plunkett 1 Oct. 1963 7 p
(RG-TN-63-6; AD-442723)

Some conformal coatings cause glass diodes to crack during thermal shocks required by military specifications. Test results indicate that epoxy resin conformal coatings are more likely to crack the diodes than polyurethane coatings. From photographs of the cracked diodes, it appears that the contraction and expansion of the coating applies radial tension on the glass body of the diode to cause the cracks. Author

N64-32440 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ADVANCES IN SOLID-STATE MICROWAVE DEVICES
Wesley G. Matthei Jul. 1964 59 p refs
(USAEL-TR-2476; AD-605923)

A review is presented of the state-of-the-art of microwave solid-state amplifiers, generators, and switches. The state-of-the-art of the recent, new microwave bulk-effect devices, phonon devices, hot-carrier thermoelectric devices, superconducting parametric amplifier, and the Gunn effect generator are summarized. Author

N64-32452 Trinity Coll., Dublin (Ireland) Physical Lab.
SINGLE ELECTRON SPECTRA IN PHOTOMULTIPLIERS Quarterly Technical Status Report, 1 Mar.–31 May 1964
Cyril F. G. Delaney 19 Jun. 1964 6 p refs
(Contract DA-91-591-EUC-3192)
(QTSR-2; AD-449204)

Consideration has been given to the rather critical specifications of the semiconductor detector and associated electronics to be used for electron detection. A charge sensitive amplifier for low-noise operation, using a field-effect transistor, has been constructed. On photomultipliers, the work has been concerned with the "tail" seen on spectra of some of the tubes (type 95245). Experimentally, it was shown that this "tail" does not appear to be associated with afterpulsing. A.W.

N64-32483 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
PARALLEL NETWORK COMPUTER (SOLOMON) Final Report
Griffiss AFB, N.Y., RADC, Aug. 1964 182 p
(Contract AF 30(602)-2724)
(Rept.-406A2; RADC-TDR-63-261, Vol. 11, Pt. 1; AD-606574)

This volume consists of a detailed description of the design of the SOLOMON computer and its various components. Subsequent discussions describe in more detail each functional unit in the system (i.e., the PE network, the network control unit, etc.), and their subunits (i.e., adders, decoding, network, etc.). A detailed description of each operation and its timing is provided. A circuit diagram of all logical elements to be employed in the system is provided. The report is intended solely as a design reference manual. Author

N64-32490* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
A MICROCIRCUIT 75-COUNTER
John L. Way 10 Aug. 1964 11 p ref
(Contract NAS7-100)
(NASA-CR-59000; JPL-TR-32-645) OTS: $1.00 fs; $0.50 mf

A synchronous 75-counter using a repetitive, truncated, binary sequence is described. The counter is designed with the Veitch diagram simplification technique and is implemented with the Fairchild microcircuit J-K flip-flop. It is free from undesirable closed loops, returns to normal sequence in a maximum of one clock-pulse time, and is capable of speeds to 8 Mc at room temperature. Minimum and maximum power-supply voltage for correct sequencing is shown as a function of temperature from −50 to +125° C. Author

N64-32499 Army Signal Research and Development Agency and Lab., Fort Monmouth, N. J. Army Electronics Lab.
CONSTRUCTION AND PERFORMANCE OF HIGH CURRENT AIR-GAP SWITCHES
Rudolf G. Buser and John J. Sullivan Jul. 1964 24 p refs
(USAEL-TR-2484; AD-605429)

From an experimental study of the properties of single-channel air-gap switches, the design and performance of efficient multichannel switches are derived. These switches have the ability to handle currents of several million amperes, to hold off high voltages, and to switch in times of the order of 10^{-8} seconds, with an inductance in the order of 10^{-8} henries. Author

N64-32508 New York U., N.Y. Electron Tube Group
PROJECTS DEALING WITH ADVANCED ELECTRON DEVICE TECHNOLOGY Status Report No. 78
Washington, Office of the Director of Defense Res. and Eng., Advisory Group on Electron Devices, Dec. 1963 47 p refs
(Contract DA-36-039-SC-89076)
(SR-78; AD-449201)

Reported is research on the development, evaluation, and production of microwave, low-power, high-power, special, and passive devices. Progress in reliability, life, and environment studies of these devices is summarized. R.L.K.

N64-32522 Autonetics, Anaheim, Calif.
RESEARCH ON INTEGRATED CIRCUIT DESIGN FOR A LOW-COST INERTIAL GUIDANCE SYSTEM Interim Engineering Report
W. F. de Boice 3 Sep. 1964 72 p refs
(Contract AF 33(615)-1629)
(T4-1448/32; AD-448036)

It is the purpose of this contractual effort to exploit present microminiaturization techniques for the development of a low-cost, reliable inertial guidance system. The effort includes studies of system requirements necessary to define the electronic functions, followed by detailed design of an appropriate set of integrated circuits that are consistent with the present fabrication technology. In the course of the effort to date, a number of novel circuit techniques have been invented. Specific definitions of the elementary devices to be used in the circuits have been completed, and the majority of the circuit configurations have been determined. Author

N64-32550 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
COMPOSITE REPORT ON PROBLEMS OF SPECIAL INTEREST TO THE EW INTELLIGENCE EFFORTS
Paul Scheibe 23 Mar. 1964 44 p refs
(Contract DA-36-039-AMC-00088(E))
(EDL-M636; AD-447974)

A technique for the approximation of an ideal network function by a realizable function is described. The operation of phase-locked oscillators in the presence of two sinusoidal signals is analyzed. The resolution of the two signals into a single sinusoidal signal with approximate phase and amplitude is discussed. The parameters of a linear time-invariant control system are analyzed, and the problem of error minimization is discussed. Each computer program written during the reporting period is summarized. Author

N64-32559 Michigan U., Ann Arbor Electron Physics Lab.
RESEARCH AND DEVELOPMENT ON HIGH-POWER CRESTATRONS FOR THE 100–300 MC FREQUENCY RANGE Quarterly Progress Report, Apr. 1–Jul. 1, 1964
G. T. Konrad and C. K. Rhee Jul. 1964 35 p ref
(Contract NObsr-81403)
(QPR-16; AD-446287)

Trajectory plots for two $P_\mu = 20$ hollow-beam electron guns are shown. A combination of electrostatic and magnetic focusing is employed. The addition of magnetic focusing is shown to simplify the gun geometry and the lens requirements in one case, while in the other case a better behaved beam is obtained. The data on an electrostatically focused tube is presented. Even though beam transmission is not ideal either with or without rf drive, it is shown that rf defocusing is not so severe as to limit large-signal operation of the tube. The final design of the magnetically focused 100-W tube is presented. Data on cold tests of the tube and on gun performance are given. Design considerations for the final method of beam focusing are enumerated. Author

N64-32569 Bell Telephone Labs., Inc., New York, N.Y.
MICROWAVE DIODE RESEARCH Eighth Quarterly Progress Report, 10 Mar.–9 Jun. 1964
J. C. Irvin and R. L. Johnston 20 Sep. 1964 33 p refs
(Contract DA-36-039-SC-85325)
(Rept.-17; AD-447552)

GaAs varactors for harmonic generator application have been fabricated on uniformly doped and on exponentially doped epitaxial layers. Some of these diodes have been employed in a 4- to 12-Gc tripler with an input power of 100 mW and a conversion efficiency of 74%. These varactors have cutoff frequencies of over 700 Gc at breakdown voltages of 30 V. Higher breakdowns up to 100 V with cutoff frequencies at breakdown of 400 to 500 Gc have also been obtained. Experimental techniques capable of measuring PIN diode-switching (control) voltage and current transients of durations less than 1.0 ns and of measuring PIN diode transient microwave impedance during switching times as short as 10 ns are discussed. The technique employs a sampling oscilloscope for voltage and current transient measurements and an additional rf signal generator for microwave impedance measurements. The circuit design features, measurement procedures, and sample results are presented. Author

N64-32621 Rome Air Development Center, Griffiss AFB, N.Y. Communications Research Branch
TRANSIENT RESPONSE OF GRADED-BASE TRANSISTORS
George L. Salton Aug. 1964 37 p refs
(RADC-TDR-64-295; AD-606795)

Basic transient properties of graded-base transistors have been examined in terms of the minority-carrier distribution in the base region, subject to the restricting conditions of a one-dimensional device geometry and low injection. The mathematical expressions for the minority-carrier distributions in the base region and for the transient times have been found. The method used was to apply various boundary conditions to the one-dimensional diffusion equation, which was solved by the "separation of variables" technique. In order to satisfy the initial conditions of individual solutions, the general solutions of the transient times are formulated in terms of infinite series. Approximate, closed form solutions for the transient times are obtained by neglecting the higher order terms of the series. Author

N64-32623 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
FREQUENCY MULTIPLIER Final Report, 15 Jun. 1963–15 May 1964
J. J. Taub, G. P. Kurpis, and J. W. Lyons [1964] 78 p refs
(Contract DA-36-039-AMC-03196(E))
(Rept.-1; AD-603449)

A theoretical investigation of microwave frequency multipliers was performed, and the efficiencies were calculated from various sources. An X-band breadboard source was designed and fabricated and yielded 9.2 Gc output from a 5.111 Mc crystal oscillator. This design included both transistor and varactor multipliers. A varactor frequency doubler from 10.65 to 21.30 Gc was also designed, and a breadboard was fabricated. In addition, the use of both varactors and varistors was investigated in frequency multiplication up to 100 Gc. Author

N64-32650 Tung-Sol Electric, Inc., Livingston, N.J. Chatham Electronics Div.
SECONDARY EMISSION ELECTRON MULTIPLIER TUBE INTERIM DEVELOPMENT (FINAL) REPORT, MAR. 21, 1962–OCT. 15, 1963
J. Mc Artney [1963] 44 p refs
(Contract Nonr-3807(00)(X))
(AD-449765)

The design of a high-power grid controlled secondary-electron emission tube is presented. The advantages of venetian-blind cylindrical geometry silver–magnesium dynodes are discussed. Various attempts at improving tube characteristics and structure are considered. A discussion of tube instability delay time and rise time, power calculations, and tube parameter graphs are included. Life test results, tube application, and future tube designs are presented. Author

N64-32658 California U., Berkeley Electronics Research Lab.
[RESEARCH IN SEMICONDUCTOR THIN FILMS AND INTEGRATED CIRCUITS] STATUS LETTER NO. 47, MAY 1–MAY 31, 1964
D. A. Hodges et al [1964] 13 p refs
(Contract AF 33(615)-1045)
(AD-449605)

The status of the following research topics is reported: (1) investigation of the possibilities of synthesizing circuit functions directly in terms of p-n junctions by analysis of several simple integrable bistable circuits; (2) crystallographic investigation of the deposited CdS thin films used in thin-film transistor fabrication; (3) study of factors influencing V_0 (dc gate bias offset voltage) in thin-film transistors using different insulating materials; (4) generalization of conditions for oscillation in electronic oscillators with semiconductor devices; (5) development of scanning electron microscopy techniques for integrated circuit studies; and (6) approximation of the influence of band gap variations in the stressed junction response of transducers and evaluation of a pressure jig and probing station for transducer studies. M.P.G.

N64-32690* General Electric Co., Schenectady, N.Y. Tube Dept.
DEVELOPMENT OF HIGH-TEMPERATURE, HIGH-CURRENT, ALKALI-METAL, VAPOR-FILLED CERAMIC THYRATRONS AND RECTIFIERS Quarterly Progress Report No. 1
A. W. Coolidge 6 Oct. 1964 29 p refs
(Contract NAS3-6005)
(NASA-CR-54181; GES-23-467) OTS: $2.00 fs; $0.50 mf

A test vehicle was designed for the initial evaluation of alkali-halide filling agents that might be used in vapor discharge tubes designed to operate at 600° C ambient temperature. Test results from the first device indicated the possibility of an undesirable halogen cycle occurring within the device. Proposed countermeasures are discussed. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see* 06 Auxiliary Systems.

N64-31350 Eurospace, Paris (France)
EUROSPACE MEMORANDA: RELIABILITY
Jun. 1964 45 p refs
(Memo-2)

Environmental conditions encountered from the manufacture to the orbital operation of a space vehicle are summarized. The order of magnitude of the various environmental parameters induced on the satellite equipment by the "Diamant–ELDO" launchers and by the satellites themselves is given. Specifications and environmental test procedures are presented for the guidance of European manufacturers. These specifications and tests are separated into a group for transport, handling, and storage material, and a group for standby, launching, orbital flight, and recovery material. D.E.W.

N64-31427 Pennsylvania U., Philadelphia Moore School of Electrical Engineering
SYSTEM STUDY FOR SUPER MOBILE COMMUNICATIONS SATELLITE GROUND STATION Quarterly Report No. 3, 1 Jan.–31 Mar. 1964
F. Haber, M. Akiyama, K. Ya'coub, J. Feld, R. Moff et al 30 Apr. 1964 118 p refs
(Contract DA-36-039-AMC-03219(E))
(Rept.-64-15; AD-602003) OTS: $4.00

On modulation systems, an analysis is given of the input-signal power requirements for specified output-signal-to-noise quality, employing orthogonal multistate waveform PCM systems. A comparison with results on FM feedback systems is included. On antenna studies, a method for calculating effective antenna noise temperature vs angle of inclination is developed. Results of a continuing study of a phased array using a variable dielectric for beam pointing are reported. On acquisition and tracking systems, an analysis of antenna pointing error as a function of ground error is presented, and work done on calculation of pointing instructions from satellite and ground station location is reported. On low-noise receivers, the results of a survey of available and potential devices are presented. Author

N64-31515 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TECHNICAL NEWS NOTES AND ITEMS OF INTEREST IN AERONAUTICS
In its Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 13–16 (See N64-31513 23-17)

Brief résumés of the following news items are presented: (1) delivery of pilot-training cabin for the BAC-111 airplane to Braniff International Airways; (2) delivery of Caravelle airliners for the Yugoslav Transport Organization; (3) aircraft production in Italy; (4) problems of the West German aeronautics industry; (5) another attempt by American carriers to increase the profit margin on aircraft; (6) marketing of a miniature computer, UNIVAC 1824, that is particularly adaptable to guidance and onboard control; (7) marketing of the Lear-Siegler cloud radar; and (8) use of the Lockheed Jetstar for training purposes. M.P.G.

N64-31551* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CALIBRATION TESTS OF THE MSFC 14 x 14-INCH TRISONIC WIND TUNNEL
Erwin Simon 20 Aug. 1964 30 p refs
(NASA-TM-X-53113) OTS: $2.00 fs; $0.50 mf

This report presents calibration data obtained from a 14- x 14-in. trisonic wind tunnel for the Mach range of 0.2 through 5.0. Pressure distribution data for the 20° cone–cylinder are presented for the Mach range of 0.90 through 5.00. Static pipe Mach number surveys are presented for the entire calibrated Mach range of 0.2 through 5.0. Flow inclinations are presented for the Mach range of 0.2 through 5.00. Author

N64-31564* National Aeronautics and Space Administration, Washington, D.C.
IMPROVEMENT OF A SHORT-ARC WIND TUNNEL BY THE USE OF A ROTATING ARC IN THE HIGH-PRESSURE CHAMBER [AMELIORATION D'UNE SOUFFLERIE A ARC BREF PAR LA REALISATION D'UN ARC TOURNANT DANS LA CHAMBRE HAUTE PRESSION]
M. Delattre Sep. 1964 11 p Transl. into ENGLISH from the Proc. of the AGARD-NATO Specialists, Meeting, Rhode-Saint-Genèse, Belgium, 3–6 Apr. 1962, AGARDograph no. 68, ch. 16, 1962 p 315–322
(NASA-TT-F-9079) OTS: $1.00 fs; $0.50 mf

Expected advantages in the use of a rotating arc in the high-pressure chamber are these: a reduction of the average value of the arc-voltage irregularities; possible achievement of a very low rate of solid pollution within the discharge, by avoiding the breaking away of solid particles; and the capability of encompassing practically the entire volume of the arc chamber, thus producing a mixing effect able to promote the homogenization of the gas temperature. Experiments were carried out with rotating arcs inside and outside the arc chamber. E.C.

N64-31662 General American Transportation Corp., Niles, Ill. MRD Div.
DESIGN OF AN INTERNAL ENVIRONMENTAL SIMULATOR FOR A MAN-MACHINE SYSTEM Final Engineering Report
R. A. Landes, R. B. Neveril, and C. M. Tomsic Oct. 1963 129 p refs
(Contract N61339-1097)
(NAVTRADEVCEN-1097-1; AD-442643)

This report summarizes the state-of-the-art of operational equipment for providing a life-supporting internal environment in a vehicle operating in a hostile external environment. Physiological requirements were determined for support of a three-man crew in a closed compartment on a 2-week mission in a hostile environment in order to design water recovery, oxygen regeneration, and cabin gas-conditioning systems. D.E.W.

N64-31668 Naval Ordnance Lab., White Oak, Md.
NOL HYPERSONIC TUNNEL NO. 4 Aerodynamics Research Report No. 176
James E. Danberg, Robert T. Schroth, Ada P. Jackson, and Francis W. Brown Oct. 1964 57 p refs
(NOLTR-62-47; AD-448220)

This report summarizes the pertinent aerodynamic design criteria and operating experience compiled during the first 11 years of operation of NOL's hypersonic tunnel number 4. Included are descriptions of the major components and their performance, along with the flight simulation capability of the facility and a bibliography of previously published reports. Author

N64-31670 Naval Ordnance Lab., White Oak, Md.
NOL HYPERSONIC SHOCK TUNNEL FACILITIES Ballistic Research Report No. 120, 1 Dec. 1963
J. W. Watt and P. M. Aronson Aug. 1964 27 p refs
(NOLTR-63-259; AD-447153)

This report includes a description of the capabilities and the limitations of the NOL hypersonic shock tunnel facilities presently in operation, and a discussion of some of the associated instrumentation used with these facilities. Author

N64-31671 Naval Ordnance Lab., White Oak, Md.
PERFORMANCE ANALYSIS OF AN AC ELECTRIC ARC POWER SUPPLY Aerodynamics Research Report No. 219
Richard L. Humphrey Oct. 1964 39 p refs
(NOLTR-63-275; AD-448455)

The performance of the power supply of the 3-MW research arc is predicted by an analysis that represents the arc voltage as a square wave in a series circuit consisting of a voltage source, a limiting reactor, resistance of the substation, and the arc voltage. An analysis is made, assuming that only a limiting reactor is in the arc circuit. An analysis with both reactance and resistance present is performed. The results are in good agreement with experimental data from the arc. Author

N64-31676 Martin Co., Baltimore, Md. Space Systems Div.
DETECTION METHODS, SLOW MALFUNCTIONS
L. Rourke 15 May 1964 92 p refs
(LV-307A; AD-448613)

Methods for detecting slow malfunctions in the Gemini vehicle during flight are described. Forty-two malfunction events are described, along with the diagnostic logic, which assumes real-time computer evaluation and display of data for human monitor observation and decision making. D.E.W.

N64-31740 Manchester Coll. of Science and Tech. (Gt. Brit.)
LABORATORY SIMULATION OF LUNAR LUMINESCENCE Final Report
J. E. Geake Jul. 1964 9 p refs
(Contract AF 61(052)-379)
(AFCRL-64-749; AD-606650)

Equipment is described that was constructed for irradiating, with protons and with uv radiation, samples of materials, that may be like those on the lunar surface. The spectrum of the resulting emission was obtained by a photoelectric spectrophotometer, which is also described. A type of material was found that luminesced strongly under proton bombardment; its main emission was at the far red end of the spectrum. This led astronomers to observe the moon through filters centered on the red peak of emission in order to find parts of the lunar surface luminescing in this way. Preliminary results suggested that at least one such region was found. Most of the samples investigated consisted of dust ground from different types of meteorites. This report chiefly summarizes information appearing in publications and technical notes. R.L.K.

N64-31837 Martin Co., Baltimore, Md. Space Systems Div.
EFFECTS OF SLOW MALFUNCTIONS
R. Oehlri and J. E. Clements 27 Apr. 1964 102 p refs
(Contract AF 04(695)-394)
(LV-306; AD-448608)

A slow malfunction error analysis has been made of the launch trajectory for a Gemini launch vehicle. Forty-three simulator runs were used as a basis of the analysis. Both nominal and slow malfunction runs were completed. Switchover from the primary to the secondary flight control system was performed at various flight times before BECO. From the resulting data, constraint boundaries were determined for violation of design criteria for vehicle structural temperature, radar look angle, and inability to complete 1 1/2 orbits. Data were also obtained for the vehicle strength constraint but the data were not of sufficient depth to show a boundary. These boundaries are presented as plots of velocity vs flight path angle and altitude for use with the Slow Malfunction Monitor Display plotting boards. Author

N64-31838 Martin Co., Baltimore, Md. Space Systems Div.
DETECTION METHODS SLOW MALFUNCTIONS
L. Rourke 1 Apr. 1964 61 p refs
(LV-307; AD-448610)

Switchover recommendations by the slow malfunction monitoring facility require a logical diagnosis of malfunction events as they develop. Twenty-three of the most easily diagnosed events are described together with the diagnostic logic. Some of the events are considered "rapid" malfunctions if they occur during unfavorable combinations of wind and dynamic pressure. A tentative listing of dispersions, wind environments, operator confusion factors, and malfunction events planned for operator training simulations is included. Author

N64-31896 Belfour Engineering Co., Suttons Bay, Mich. Technical Information Systems Div.
THE MECHANICAL PROPERTIES DATA CENTER OPERATION AND EXPANSION Summary Technical Report, 1 Apr. 1963–31 Mar. 1964
R. C. Braden and C. S. Wright Wright-Patterson AFB, Ohio, Air Force Mater. Lab., 3 Aug. 1964 61 p refs
(Contract AF 33(615)-1061)
(ML-TDR-64-235; AD-605815)

This report discusses the content, use, and operation of the Mechanical Properties Data Center. Search frequency, data input, document acquisition, and link-role indexing are discussed. A review of project activities expressed as percentages of expended effort is presented. Author

N64-31907 Industrial Nucleonics Corp., Columbus, Ohio
MISSILE LIFT OFF MEASUREMENT Final Report
A. J. Campanella Griffiss AFB, N.Y., RADC, Jun. 1964 440 p refs
(Contract AF 30(602)-3123)
(RADC-TDR-63-535)

A feasibility study and analysis has determined that a nucleonic tracking method can be used to provide a missile lift-off measurement system for all-weather tracking of missiles at the AMR during the early lift-off phase. During the first 500 ft of flight, accuracies of 0.05 ft in position, 0.02 fps in velocity, and 0.01 fps^2 in acceleration can be achieved with postflight analysis of acquired data. Experiments were conducted to investigate the nucleonic tracking method; a system analysis was performed; and a recommended system design was synthesized. Author

N64-31949 General Dynamics/Fort Worth, Tex.
EXPERIMENTAL RESULTS OF CIRCULAR POLARIZATION AND SCATTERING MATRIX MEASUREMENTS

B. A. Benn and C. C. Freeny Griffiss AFB, N.Y., RADC, Jun. 1964 45 p refs
(Contract AF 30(602)-2831)
(FZE-222-2; RADC-TDR-64-380; AD-605520)

This report contains a description of the results of experiments performed at the RAT SCAT Site, a ground plane radar cross section range, to examine the operational feasibility of measuring arbitrary targets with circular polarization and of measuring linear scattering matrices. A calibration procedure compatible with the RAT SCAT facility is presented. Elliptical polarization was used to facilitate the establishment of circular polarization at the target point. Experimental data are presented on the magnitude of polarization degradation as a function of target size and time. Relative phase measurements, along with the necessary amplitude measurements, were used to determine the linear scattering matrix of a complex target. Two annotated schemes compatible with present RAT SCAT equipment for obtaining the linear scattering matrix are described. Author

N64-31950 General Dynamics/Fort Worth, Tex.
RADAR CROSS SECTION TARGET SUPPORTS—METAL COLUMNS AND SUSPENSION DEVICES
R. A. Ross Griffiss AFB, N.Y., RADC, Jun. 1964 76 p
(Contract AF 30(602)-2831)
(FZE-222-5; RADC-TDR-64-382; AD-606122)

The shielded metal column program was devoted specifically to the investigation of errors in cross section measurement resulting from the use of a large, hydraulically actuated metal target support at the RAT SCAT site. The analytical model used and the factors taken into consideration in arriving at a test program for use in evaluating shielding techniques for the metal target support are described. A scale ground plane range was used to simulate low-frequency operation on the RAT SCAT range. Most of the measurements made were for the purpose of determining the cross section return of such conventional suspension target supports as nylon. The parameters of primary concern were size and the polarization of the transmitter and receiver. Author

N64-32007 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
HIGH RESOLUTION ENERGY LOSS MAGNETIC ANALYSER FOR SCATTERING EXPERIMENTS
C. Schaerf and R. Scrimaglio 28 Jul. 1964 6 p refs Submitted for Publication *Its* Nota Interna No. 256
(LNF-64/41)

A new magnetic analyzer is proposed for scattering experiments. This particular spectrometer analyzes directly and with high resolution the energy loss in the target. It requires a very weak resolution of the primary beam. It is an integrated analyzer in the sense that it integrates the functions of magnetic analysis of the particles before and after the scattering event. Basically the analyzer consists of a magnetic system that is achromatic, symmetric, and has an intermediate focus in the middle. The first half introduces dispersion in the beam, and the second half focuses all the particles back in the same point irrespective of their energy. Author

N64-32008 Argentina Comision Nacional de Energia Atomica, Buenos Aires
CONSTRUCTION OF AN ELECTROMAGNETIC ISOTOPE SEPARATOR [CONSTRUCCION DE UN SEPARADOR ELECTROMAGNETICO DE ISOTOPOS]
Moises J. Sametband 1964 32 p refs In SPANISH; ENGLISH summary *Its* Informe No. 113

The electromagnetic isotope separator is of the 180° type, with a radius of curvature of 100 cm and a gap width of 17 cm. The magnetic field, stabilized in 1:10 000, ranges from 300 to 4300 gauss, and the pole pieces are corrected to give a good focusing for an ion beam, which diverges up to 30°. The profile of the pole pieces was designed after a series of measurements using a model magnet and an analogic method, obtaining a discrepancy of not more than 0.5% with respect to the theoretical field. The ion source is of the hot filament type, and a furnace enables the vaporization of almost all elements. The accelerating system was designed with the aid of an analogic method that simulates the space charge of an intense ion beam. Author

N64-32009 Argentina Comision Nacional de Energia Atomica, Buenos Aires
SOURCE OF IONS FOR AN ISOTOPE SEPARATOR [FUENTE DE IONES PARA UN SEPARADOR DE ISOTOPOS]
Moises J. Sametband 1964 37 p refs In SPANISH *Its* Informe No. 114

The ion source actually used in the isotope separator of Buenos Aires is described. It consists of a hot cathode, with a collimated arc for the separator magnetic field, and with a large oven for evaporating materials at temperatures up to 700° C. Measurements were made with silver, nickel, and zinc that permit the determination of diffusion coefficients for the discharge. Problems are discussed that are connected with the best pressure for the discharge chamber. The effects of the acceleration system on the ion beam, which is of several mA, are described. The space charge tends to diminish the separator power of the apparatus. This effect is considerably reduced if the beam is made convergent on the exit groove of the ion source. A method is described that permits the design of accelerator systems for ion beams with space charge and predetermined form. Trans. by D.E.W.

N64-32015 National Research Council of Canada, Ottawa
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL–30 JUNE 1964
[1964] 121 p refs
(DME/NAE-1964 (2))

This paper covers developments in pure fluid systems with emphasis on some complex pure fluid components and typical systems. Schematic symbols and typical circuits are illustrated, and manufacturing techniques, problem areas, the present state-of-the-art, and potential applications are discussed. A brief bibliography of additional information is given. The potential hazard of birds to airplanes is observed, and preventive methods are recommended; they include ecological changes in airport surroundings, and the combined use of suitable distress calls and pyrotechnics. Current projects of the Division of Mechanical Engineering and the National Aeronautical Establishment include the following: "Mechanics"; "Hydrodynamics"; "Aerodynamics"; and "Thermodynamics." G.G.

N64-32067 Rensselaer Polytechnic Inst., Troy, N.Y.
THE DESIGN AND CONSTRUCTION OF A HIGH TEMPERATURE LABORATORY
Nathan G. Tupper (M.S. Thesis) Jun. 1964 36 p refs
(AD-602230) OTS: $2.00

The work was concerned with the design and construction of a high-temperature laboratory for use in investigation of the first and second stages of creep. The modification of four lever-arm units is described, with emphasis on the reduction

of tare load, the minimizing of bending stresses on the specimen, and the improvement of the strain-measuring system. The design and construction of six dead-weight units is described. A unique loading system consisting of a barrel roller bearing, universal joint, and chain is presented. An accurate, automatic system for measuring and recording strain is described. The selection of proper furnaces and controlling equipment is described. Wiring diagrams, drawings, and schematic diagrams are presented where pertinent. Author

N64-32217 Office of Naval Research, Washington, D.C.
AN EXPLORATORY STUDY IN RESEARCH PLANNING METHODOLOGY
Herman I. Shaller Sep. 1963 19 p ref
(ONR-ACR/NAR-27)

A quantitative methodology for use as an aid to research program planning is sought. An operations research approach to the problem is described, and a generalized systems concept of the research planning process is outlined as background material for the analytical techniques proposed. There are three basic ingredients to the proposed research planning system. The first is the concept of a category-attribute matrix, which describes numerical relationships between desired attributes of a research program and categories of research. The matrix yields a numerical output called "effectiveness." The second ingredient is a predetermined collection of classification systems, which suggests a set of constraints for a balanced program. The third ingredient is a perturbation technique that is used to answer questions posed to the system. Five theorems are proved, and a model consisting of numerical arrays has been formulated to characterize the state of a program. Author

N64-32351* National Aeronautics and Space Administration, Washington, D.C.
STL TO COMPUTE GEMINI, APOLLO MISSIONS SIMULATIONS News Release 64-206
20 Aug. 1964 3 p
Available from the Scientific and Technical Information Division

Mission simulation in the two programs will cover a variety of phases, starting with booster launch, and progressing to reentry and recovery of the spacecraft and astronauts. Computer programs will be developed to represent actual flights. Descriptive data in the simulation include characteristics of the launch vehicle and the spacecraft—weights, thrust, fuel utilization, and structural limits; atmospheric conditions—winds to be encountered in ascent and descent, laws to be observed by the guidance system, and limitations imposed for astronaut safety. These, together with the date of the expected launch, are used to derive mission strategies, payload-weight limitations, communication requirements, etc. R.L.K.

N64-32399 ITT Federal Labs., Nutley, N.J.
CAPE FEASIBILITY STUDY Monthly Progress Report, 1–30 Sep. 1964
[1964] 10 p
(MPR-12)

The status of work is reported for a computer-simulation program, documentation, and a computer evaluation of feasibility of a CAPE short-range system. A specification was prepared that defines the link switch components, and logical design progress is reported. Flow charts for the In–Out Control (IOC) Unit hardware were being prepared. The progress of work and the status of other components of the IOC are reported. D.E.W.

N64-32406* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
TECHNIQUE FOR THE SIMULATION OF LUNAR AND PLANETARY GRAVITATIONAL FIELDS INCLUDING PILOT MODEL STUDIES
Huey D. Carden, Robert W. Herr, and George W. Brooks Washington, NASA, Oct. 1964 20 p refs
(NASA-TN-D-2415) OTS: $0.50

The basic principles of the technique involve dropping the spacecraft (or payload) onto an appropriate impact surface that is undergoing the desired acceleration relative to the freely falling spacecraft or payload. An effective gravitational acceleration equal to the difference between the acceleration of gravity on the earth and the acceleration of the impact surface is then experienced by the vehicle at impact. The performance of a pilot model simulator that utilizes the technique was also evaluated. Studies were conducted in the simulator to determine the effect of reduced gravitational acceleration on the behavior of simple models during landing. Markedly reduced tipover stability was demonstrated for the impact of the models onto a sandy surface and for the case in which the model collided with an obstacle shortly after landing. Author

N64-32488 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
JPL INTENSE FIELD AIR CORE MAGNET
Rudolph Rust, D. D. Elleman, and R. M. Noble 31 Aug. 1964 20 p refs
(Contract NAS7-100)
(NASA-CR-59054; JPL-TR-32-652) OTS: $1.00 fs; $0.50 mf

An intense magnetic field facility has been completed. This report gives descriptive information summarizing major system design considerations and an evaluation of the recently completed magnet facility. Author

N64-32489* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
DEVELOPMENT OF THE JET PROPULSION LABORATORY SOLAR SIMULATOR, TYPE A
Ralph E. Bartera and Roger M. Barnett 15 Jul. 1964 21 p
(Contract NAS7-100)
(NASA-CR-59051; JPL-TR-32-638) OTS: $1.00 fs; $0.50 mf

This report describes the solar simulation development activities of late 1962 through 1963 that culminated in the production of the Solar Simulator Design Type A. A brief history of this development, together with the outstanding actual performance of the JPL-SS-A6, is presented. Author

N64-32491* Martin Co., Baltimore, Md. Electronic Systems and Products Div.
PERFORMANCE MEASUREMENT IN FLIGHT SIMULATION STUDIES Engineering Report No. 13168
R. W. Obermayer and F. A. Muckler Aug. 1963 31 p refs
(Contract NASw-718)
(NASA-CR-59063) OTS: $2.00 fs; $0.50 mf

Objectives of the simulation experiments and their limitations are discussed. Applications of performance measurement are discussed at length, with special attention being paid to development of man–machine models. General measurement criteria are discussed, and the selection of response measure is treated at length. D.E.W.

N64-32524 RAND Corp., Santa Monica, Calif.
DETERMINING ECONOMIC QUANTITIES OF MAINTENANCE RESOURCES: A MINUTEMAN APPLICATION
Chauncey F. Bell and Milton Kamins Jan. 1963 57 p refs
(Contract AF 49(638)-700; Proj. Defender)
(RM-3308-PR; AD-407200)

This memorandum introduces a technique for computing quantitative maintenance manpower and maintenance ground equipment requirements, taking into account four of the most critical factors: frequency of demand for the resource; maintenance time necessary for servicing the resource; randomness of the demand pattern—the uncertainty about the time of any particular malfunction; and the cost-effectiveness factors—the value of the marginal increase in system capability weighed against the marginal cost of resources required to achieve that capability. Using published utilization estimates and the pertinent cost information, sets of charts developed for the purpose are used to arrive at appropriate manpower and ground equipment quantities. This study makes no effort to alter current qualitative requirements methodology. Author

N64-32528 National Bureau of Standards, Boulder, Colo.
PROCEEDINGS OF THE 1962 STANDARDS LABORATORY CONFERENCE, BOULDER, COLORADO, 8–10 AUGUST 1962
A. V. Astin et al 16 Aug. 1963 262 p refs
(NBS Misc. Publ.-248) GPO: $1.75

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N64-32538 Naval Ordnance Test Station, China Lake, Calif.
ANALYTICAL INVESTIGATION OF ROCKET SLED VIBRATIONS EXCITED BY RANDOM FORCES
Gary K. Fisher and W. J. Stronge Jul. 1964 64 p refs
(NAVWEPS-8546; NOTS-TP-3556; AD-447976)

A theoretical analysis of the forced vibrations of a single-degree-of-freedom, linear system having viscous damping is presented. The vibrations are excited by the system traveling over a specific random surface–the Supersonic Naval Ordnance Research Track (SNORT). Thus, the time-history of the forcing function and the statistical measures of the response reported depend on the velocity of the system along that track. The response of this model has been related to a dynamic loading factor for track vehicles that corresponds, within a factor of 2, to experimental measurements. Author

N64-32549 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
MOTION CHARACTERISTICS OF NRL PLATFORM (FORDS) IN WAVES
John Foster Aug. 1964 28 p refs
(DTMB-1855; AD-605374)

Tests were conducted in the Seakeeping Facility on a 1/40-scale model in regular and irregular waves. In general, the motions at the light draft were comparable in magnitude to those of a cargo-type ship of the same displacement. However, at the deep or operating draft, the motion of the platform was reduced considerably. Author

N64-32592 Air Force Dept., Washington, D.C. Office of Aerospace Research
UNITED STATES AIR FORCE RESEARCH ACCOMPLISHMENTS
Jun. 1964 143 p refs
(OAR-64-6; AD-604907)

Brief descriptions are presented of experimental findings believed to have contributed markedly to advances in applied research and technology. The fields of research have included the following: (1) Physical Sciences—general physics, nuclear physics, chemistry, and mathematical sciences; (2) Engineering Sciences—electronics, materials, mechanics, and energy conversion; (3) Environmental Sciences—oceanography, terrestrial sciences, atmospheric physics, and astronomy–astrophysics; and (4) Life Sciences—biological and medical sciences, and behavioral and social sciences. D.S.G.

N64-32610 Belfour Engineering Co., Suttons Bay, Mich. Technical Information Systems Div.
MECHANICAL PROPERTIES DATA CENTER DESIGN AND OPERATION Technical Documentary Report, 15 Jun. 1962-15 May 1963
F. L. Stulen Sep. 1963 56 p refs
(Contract AF 33(657)-9149)
(ASD-TDR-63-566, Pt. I; AD-414396)

This report discusses and describes the concepts and considerations as well as design details of a system capable of storing and retrieving mechanical properties information of metals and reinforced plastics. Included is a description of IBM card layout and codes utilized to store, retrieve, operate on, and display the most pertinent numeric and alphabetic information necessary to the description of reported test procedures and results. Examples of graphic and tabular system output are also presented. Author

N64-32620 Westinghouse Electric Co., Baltimore, Md. Aerospace Div.
PARALLEL NETWORK COMPUTER (SOLOMON) APPLICATIONS ANALYSES Final Report
Griffiss AFB, N.Y., RADC, Aug. 1964 281 p refs
(Contract AF 30(602)-2724)
(Rept.-406A2; RADC-TDR-63-261, Vol. III; AD-606578)

This volume presents the study of the applicability of the SOLOMON Parallel Network computer system to 10 varied problem areas. The report, where possible, contrasts the running time of SOLOMON with the running time of a commonly used, conventionally organized computer in the solution of each problem. The conclusions drawn in this report indicate that the SOLOMON system offers speed advantages of from one to three orders of magnitude in these major data-processing problem areas. Author

N64-32671 European Organization for Nuclear Research, Geneva (Switzerland) Nuclear Physics Apparatus Div.
A PULSED BEAM TRANSPORT SYSTEM FOR THE EXTERNAL PROTON BEAM OF THE CERN PROTON SYNCHROTRON
B. Langeseth 2 Jul. 1964 29 p refs
(CERN-64-35)

A system of pulsed-beam transport magnets was constructed for the CERN neutrino beam. Its function is to guide and focus the fast ejected proton beam of the CERN Proton Synchrotron onto a small external target located at the entrance of a special magnet—the magnetic horn—that deflects the major part of the secondaries into a decay tunnel in the direction of the neutrino detectors. The report describes in some detail the beam-transport equipment. It is concluded from the high efficiency of the beam in the neutrino experiment that the apparatus is very satisfactory. E.C.

N64-32678 Oklahoma State U. Research Foundation, Stillwater
THERMODYNAMIC PROPERTIES OF ZIRCONIUM AND HAFNIUM HALIDES Quarterly Progress Report, 23 Apr-16 Jul. 1964
Robert D. Freeman, P. D. Gwinup, and W. C. Parks 16 Jul. 1964 6 p
(Contract AF 33(615)-1449)
(QPR-2; AD-449606)

Assembly of the differential thermal analysis apparatus is in progress. Poor experimental precision and failure of a component in the old calorimeter vessel necessitated the construction of a new vessel. Author

N64-32682 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.

SOME LIMITATIONS ON THE PERFORMANCE OF HIGH-VELOCITY GUNS

John S. Curtis Aug. 1964 14 p refs

(Contract DA-04-495-ORD-3567(Z); ARPA Order 357-63; Proj. Defender)

(CTN-64-03; AD-448060)

The velocity regime over which the light-gas gun would be useful is discussed by considering the ratio of accelerating forces to the strength of the projectile. The theoretical upper limit of the velocity at which a projectile of a given length can be launched in a specified gun is compared to experimental firings with satisfactory agreement. The conclusions indicate that the size of the gun necessary for any test is a critical function of the velocity of the test and the size of the projectile, and that, if free-flight range testing is to be done at a velocity of 40 000 fps, the size of the model must be small regardless of the size of the gun. D.S.G.

N64-32683 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.

SABOTS

John S. Curtis Aug. 1964 9 p

(Contract DA-04-495-ORD-3567(Z)); ARPA Order 357-63; Proj. Defender)

(CTN-64-04; AD-448061)

A sabot was designed for the gun-launching of aerodynamic models. The material chosen was Lexan, Type-M, a vacuum-annealed polycarbonate resin; it satisfied the requirements that it be light enough not to degrade gun performance, strong enough to withstand the forces of acceleration, and capable of sealing the gun gases and preventing excessive leakage past the model. The sabot was constructed in longitudinal sections with serrated mating surfaces so that firm locking was provided in the gun, yet the pieces separated freely after leaving the gun barrel. Using this saboting technique, both cones and spheres were launched at velocities in excess of 24 000 fps. R.L.K.

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-31429 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

REPORTS OF THE INSTITUTE OF HIGH SPEED MECHANICS, VOLUME 15, 1963/1964

[1964] 194 p refs

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3. METHOD TO GET PROFILE OF NOZZLE WITH GIVEN VELOCITY DISTRIBUTION ALONG NOZZLE AXIS. REPORT 2: THEORY OF AXIALLY SYMMETRIC POTENTIAL FLOW A. Shima p 45–70 refs (See N64-31432 23-11)

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6. THEORY FOR SUPERCAVITATING FLOW THROUGH AN ARBITRARY FORM HYDROFOIL R. Oba p 109–122 refs (See N64-31435 23-11)

7. TWO DIMENSIONAL POTENTIAL THEORY ON FLOW THROUGH BEND OF ARBITRARY PROFILE S. Kamiyama p 123–142 refs (See N64-31436 23-11)

8. HEAT TRANSFER OF PARTICLES IN THE DOMAIN WHERE NATURAL AND FORCED CONVECTION CO-EXIST T. Tsubouchi and S. Sato p 143–158 refs (See N64-31437 23-13)

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10. THE EFFECT OF PRANDTL NUMBER ON THE NATURAL CONVECTION HEAT TRANSFER OF SMALL PARTICLES T. Tsubouchi, S. Sato, and H. Masuda p 179–191 refs (See N64-31439 23-13)

N64-31430 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

THEORY ON SUPERCAVITATING HYDROFOILS AT ARBITRARY CAVITATION COEFFICIENT

R. Oba *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 1–20 refs Presented at the Sendai Meeting of the Japan Soc. of Mech. Engr., 10 Nov. 1962 (See N64-31429 23-11)

(Rept.-141)

A simple accurate analysis is proposed for arbitrary form supercavitating hydrofoils in arbitrary cavitation coefficients. Besides, by numerical calculations, a simple formula on lift coefficient that is practically applicable to arbitrary form hydrofoils, $C_L = \sqrt{C^2_{L\sigma=0} + 0.85\ \sigma^2} + \sigma C_{L,\sigma=0}$ is found. It is also clarified that the drag-lift ratios scarcely change on cavitation coefficients. Author

N64-31431 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

CAVITATION TESTS ON HYDROFOIL PROFILES DESIGNED FOR ACCELERATING FLOW CASCADE. REPORT 2: THREE HYDROFOILS OF TYPE 2

F. Numachi, R. Oba, and I. Chida *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 21–44 refs Presented at the Sendai Meeting of the IAHR—Symp. on Cavitation and Hydraulic Machinery, 1962 (See N64-31429 23-11)

(Rept.-142)

A new method of generating original profiles with superior characteristics when used in a given cascade formation (given cascade angle θ and given pitchchord ratio t/l) instead of utilizing already established profile forms has previously been proposed for the design of blades for axial-flow turbines and

pumps as well as for ship propellers. It has been demonstrated experimentally that profiles thus developed yield performance markedly superior to those of already established profiles when incorporated in cascades of the designated formation, and have been named "cascade profiles." The new method of profile generation prescribes a suitable configuration for the pressure distribution around the profile, and then to work out theoretically the profile outline that should create the predetermined pressure distribution around it. Author

N64-31432 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

METHOD TO GET PROFILE OF NOZZLE WITH GIVEN VELOCITY DISTRIBUTION ALONG NOZZLE AXIS. REPORT 2: THEORY OF AXIALLY SYMMETRIC POTENTIAL FLOW

A. Shima *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 45–70 refs Presented at the 40th Gen. Meeting of the Japan Soc. of Mech. Engr., 1 Apr. 1963 (See N64-31429 23-11)
(Rept.-143)

In a previous report with the same title, the author proposed a method for calculating nozzle profile having a given velocity distribution along nozzle axis. It was assumed then that in the nozzle the flow is two-dimensional potential flow. Therefore, this report presents an analytical method for the same calculation but in axially symmetric flow. From the examples of numerical calculations, it is ascertained that the calculation by this method can give sufficient accuracy. Author

N64-31433 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

RESEARCH ON THE HIGH HEAD KAPLAN TURBINE. REPORT I: THE CASE WHERE EXPERIMENTAL HEAD IS CHANGED

S. Saito *In its* rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 71–92 refs Presented at the 36th Gen. Meeting of the Japan Soc. of Mech. Engr., 2 Apr. 1959 (See N64-31429 23-11)
(Rept.-144)

Experimental research was done on a model turbine with 10 runner vanes within the head region of 9 through 16 m, as the first step in determining the influence of the head on the high-head Kaplan turbine. The fact that hydraulic efficiency changes owing to the experimental head and its cause were investigated by measuring the inner flow and head loss. The aspect in which the critical cavitation factor changes owing to the experimental head is presented. Author

N64-31434 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

THEORY ON WALL EFFECTS UPON PERFORMANCE OF SUPER CAVITATING HYDROFOIL

R. Oba *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 93–108 refs Presented at the 39th Gen. Meeting of the Japan Soc. of Mech. Engr. 3 Apr. 1962 and at the Sendai Meeting of the IAHR Symp. on Cavitation and Hydraulic Machinery, 4 Sep. 1964 (See N64-31429 23-11)
(Rept.-145)

A two-dimensional theory of analysis is proposed to estimate both the wall effects and the boundary effects of a jet in the working section on a supercavitating hydrofoil of arbitrary form. By numerical calculations, it was clarified that the effects for the ordinary low-drag hydrofoils are quite small in a large width–chord ratio $t \geqq 8$ in a solid wall tunnel. Author

N64-31435 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

THEORY FOR SUPERCAVITATING FLOW THROUGH AN ARBITRARY FORM HYDROFOIL

R. Oba *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 109–122 refs Presented at the 38th Gen. Meeting of the Japan Soc. of Mech. Engr., 4 Apr. 1961 Submitted for Publication (See N64-31429 23-11)
(Rept.-146)

An accurate theory, which included the following two methods, was developed concerning the flow through an arbitrary-form supercavitating hydrofoil: (1) a method by which to obtain the hydrofoil form for a given pressure distribution; (2) a method by which to estimate hydrofoil characteristics. The accuracy of the previously reported linearized solution was checked, and then a very simple effective method for correcting the linearized solution was determined. Author

N64-31436 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

TWO DIMENSIONAL POTENTIAL THEORY ON FLOW THROUGH BEND OF ARBITRARY PROFILE

S. Kamiyama *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 123–142 refs Presented at the 40th Gen. Meeting of the Japan Soc. of Mech. Engr., 1 Apr. 1963 (See N64-31429 23-11)
(Rept.-147)

A potential theory of two-dimensional flow through a bend of arbitrary profile is developed, and analytical methods both of surface pressure distribution and of bend profile for a given arbitrary surface pressure distribution are proposed. These methods are superior in exactitude and simplicity of numerical calculation. Numerical calculations are carried out for a few bend profiles. Their calculated values of surface pressure distributions are compared with the measured values, and satisfactory agreements are obtained. Author

N64-31443* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OSCILLATING SPHERE IN A ROTATING VISCOUS FLUID

M. P. Singh Repr. from AIAA Journal, v. 2, no. 8, 1964 p 1513–1514 ref
(NASA-RP-313)

A theoretical investigation of small oscillations of a sphere in an incompressible, viscous fluid rotating with a constant angular velocity is presented. The sphere oscillates along the axis of the rotating fluid, and the effect of the Coriolis forces on the flow pattern is determined. It is shown that the azimuthal component of velocity is non zero and that the rotating effect generates vorticity. IAA

N64-31618 Lockheed-California Co., Burbank

RECOMMENDED METHODS FOR SONIC BOOM ANALYSIS DURING PHASE II-A SST PROGRAM

I. H. Culver, E. C. B. Danforth, and L. M. Kenner 18 Aug. 1964 103 p refs
(LR-18084)

The report contains recommendations for changes only in the method to be used for the estimation of sonic-boom-source strength. There is a detailed discussion of the recommended method and of the underlying physics that justifies it. It is recommended that configuration analysis be carried out by strict application of the principles of the linearized theory rather than by use of the area rule alone, as is the present custom. A.W.

N64-31660 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.

ON SYMMETRIC COMPRESSIBLE FLUID FLOWS AROUND A FLAT PLATE

Hans J. Lugt and Ernst W. Schwiderski Jun. 1964 31 p refs (NWL-1933; AD-448240)

The Navier–Stokes equations for compressible fluid flows around a flat plate permit solutions satisfying the condition that velocity and pressure are bounded at the edge. In contrast to the existence of these regular solutions, the equations of motion exclude any singular integrals for which the pressure is infinite at the edge of the plate, provided that the equation of state and the equations for viscosity, conductivity, and specific heat are sufficiently regular. Author

N64-31663 David Taylor Model Basin, Washington, D.C. Aerodynamics Lab.

SOME EXPERIMENTAL MEASUREMENTS OF PITCH AND HEAVE MOTIONS OF DTMB GEM MODEL 463 IN FLIGHT OVER REGULAR FOLLOWING WAVES

Charles W. Harry and William B. Maguire Jul. 1964 22 p refs (DTMB-AERO-1074; AD-448117)

The tests were conducted on GEM Model 463 (a 15-foot, 120-pound, powered, peripheral-jet model) operating over the deep-water basin. Qualitatively, the results indicate relatively little response to excitation from waves of length less than the model length. For longer waves, the response curves exhibit a characteristic "resonance peak," with peak response occurring at encounter frequencies slightly greater than half the reference frequency and with peak pitch and heave amplitudes slightly exceeding the maximum wave slope and wave height, respectively. Author

N64-31664 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.

CALCULATION OF OPTIMUM EFFICIENCY FOR A SERIES OF LARGE-HUB PROPELLERS FOR APPLICATION TO TANDEM PROPULSION OF A SUBMERGED BODY OF REVOLUTION

John L. Beveridge Aug. 1964 33 p refs (DTMB-1826; AD-447411)

Calculations were performed to determine the efficiency of integral bow and stern propellers for a body of revolution. Such a propulsion system leads to propellers with large hubs relative to the tip diameter and a large number of blades. The calculations were carried out for a propeller with 13 blades with various tip diameters, blade areas, and rpm's. The series results are presented, analyzed, and applied to computing the propulsion performance of a hypothetical 250-foot tandem propeller submarine. Author

N64-31703 Naval Air Turbine Test Station, Trenton, N.J. Aeronautical Turbine Lab.

THE USE OF MOMENTUM EFFECTS IN LIQUID FLOW MEASUREMENT

George F. Battista Aug. 1963 60 p refs (NATTS-ATL-TN-26; AD-420226)

A commercially available axial-flow mass flowmeter is evaluated under steady-state conditions. The effect of variations in temperature, fluid viscosity, and fluid velocity profile on flowmeter accuracy are determined. Consideration is given to the possible causes of the turbine torque dropoff exhibited at high mass-flow rates by high-viscosity fluids. Points to consider in the cut and try process of meter redesign are discussed. A theoretical analysis of the mass flowmeter transient-response capabilities is made. An axial-flow mass flowmeter that might be less sensitive to fluid viscosity variations, and more applicable for use with steady-state and transient recording systems is proposed. Author

N64-31711 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)

POTENTIAL THEORETICAL DESCRIPTION OF THE FLOW IN A JET DEFLECTED BY A CIRCULAR CYLINDER-COANDA EFFECT

Th. E. Labrujere and P. J. Zandbergen 23 Jul. 1963 57 p refs (NLR-TN-G.31)

The Coanda effect, an expedient for the application of blowing boundary-layer control, has been investigated to gain an insight into the basic principle and the laws by which it is governed. Within the framework of this investigation, a potential theory is developed that leads to a qualitative prediction of the increase in volume flow from the slot and of the force on the deflecting surface; it will be used as a basis for further theoretical analysis. Author

N64-31748 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TURBULENT BOUNDARY LAYER OF A NON-THERMOINSULATED WING OR AXIALLY SYMMETRIC BODY IN A COMPRESSIBLE LIQUID

I. P. Ginzburg and G. V. Kocheryzhenkov *In its* Herald of the Leningrad U. 28 Jul. 1964 p 102–115 refs (See N64-31742 23-23)

By formulating quadratic equations representing approximately the dependence of full enthalpy on velocity in the turbulent part of the boundary layer, an approximate solution of the gas movement problem in the turbulent boundary layer of a nonthermoinsulated profile is obtained. A.W.

N64-31750 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RELATIVISTIC INTEGRAL KINETIC EQUATIONS

N. B. Maslova *In its* Herald of the Leningrad U. 28 Jul. 1964 p 126–142 refs (See N64-31742 23-23)

A system of the Lorentz—invariant integral equations is derived for the description of the gas mixture with the internal degrees of freedom. Boltzmann's relativistic equation and the boundary conditions for it may be obtained from this system. Author

N64-31751 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FLOW PAST A BODY REVOLUTION BY A SUPERSONIC FLOW OF GAS

A. S. Mikheyev *In its* Herald of the Leningrad U. 28 Jul. 1964 p 143–152 refs (See N64-31742 23-23)

The supersonic steady flow past pointed bodies of revolution is considered. A new approximate analytical method for solution of the problem is proposed. The method is founded on the approximation of Bernoullis equation: $v(p,\psi) = a(\psi)p + b(\psi)$. Author

N64-31752 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE CALCULATION OF A BOUNDARY LAYER BY THE METHOD OF DISMEMBERMENT

L. A. Rozin *In its* Herald of the Leningrad U. 28 Jul. 1964 p153–168 refs (See N64-31742 23-23)

The computation of a laminar boundary layer in an incompressible fluid based on the dismemberment of the differential operator in the equation of motion is considered. This is reached by the introduction of some function f_0 and brings two equations containing f_0 and the longitudinal component of velocity u. The function u_1 with unknown parameters given across a boundary layer is substituted in one of the received equations. The u_2 is defined from the other equation. The unknown parameters are found by means of conditions of growing u_1 and u_2 together. Author

N64-31832 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.

COMPLETE EXPRESSIONS FOR THE GRAVITATIONAL AND BUOYANCY FORCE TERMS IN THE EQUATIONS OF MOTION OF A SUBMERGED BODY

Frederick M. Imlay Jul. 1964 14 p refs
(DTMB-1845; AD-603020)

Complete expressions are given for the forces and moments acting on a submerged body because of gravitational attraction on the mass of the body and buoyancy force acting on the body boundary. The variations of the forces and moments with changes in angular attitude of the body are discussed in detail. The relationship of these variations to the phenomenon of metacentric stability is described. Author

N64-31841 California U., Berkeley Inst. of Engineering Research

CONVECTIVE INSTABILITY OF A HORIZONTAL LAYER OF FLUID WITH MAINTAINED CONCENTRATION OF DIFFUSIVE SUBSTANCE AND TEMPERATURE AT THE BOUNDARIES

Paul Lieber and Lionel Rintel Nov. 1963 16 p refs
(Contract Nonr-222(87))
(MD-63-6)

The critical conditions for convective instability of a horizontal layer of fluid that has constant gradients of temperature and concentration of a diffusive substance are derived. The parameter determining the stability is a sum of two Rayleigh numbers—one based on the quantities determining the molecular heat transfer across the layer, and the second based on those quantities determining the molecular transfer of the diffusive substance. For liquids, a strong stabilizing or destabilizing action of the diffusion results, depending on the sign of the gradient of the concentration of salts. When the gradient of salt concentration stabilizes, overstable oscillation are found to provide the mechanism of the stabilization Author

N64-32017 Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands)

SUPPLEMENT TO THE BIBLIOGRAPHY ON BLAST, SHOCK WAVES AND ALLIED TOPICS, FEATURING NUCLEAR EXPLOSIONS

G. J. J. v. d. Knapp, Jr. Jul. 1964 101 p refs Suppl. to TDCK-30050; TDCK-30051
(TDCK-30050-S1; TDCK-30050; TDCK-30051)

N64-32027 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.

TURBULENCE IN HYPERSONIC WAKES

Alan Q. Eschenroeder Aug. 1964 26 p refs
(Contract DA-04-495-ORD-3567(Z); ARPA Order 347-63; Proj. Defender)
(TR-64-02H; AD-448711)

Regimes of turbulence are defined in an approximate manner for typical blunt- and slender-body wake flows. Mean quantities are obtained from solutions available in the literature for 1-ft bodies traveling at 22 kft/sec and at 100 kft altitude. On the basis of these quantities, turbulence properties are determined. Theoretical results are employed to convert gross features of the structure into a statistical description. Criteria that have been previously developed are used to assess viscosity, compressibility, and nonequilibrium chemical effects on the energy spectrum. Author

N64-32071 National Bureau of Standards, Boulder, Colo. Cryogenic Engineering Lab.

CHOKING TWO-PHASE FLOW LITERATURE SUMMARY AND IDEALIZED DESIGN SOLUTIONS FOR HYDROGEN, NITROGEN, OXYGEN, AND REFRIGERANTS 12 AND 11

R. V. Smith 3 Aug. 1963 134 p refs
(NBS-TN-179) OTS: $0.75

The literature summary presents a brief description and discussion of papers on choking two-phase flow. These papers are arranged with respect to analysis methods and experimental systems. The idealized solutions utilize models intended to provide upper and lower limits for the actual flow cases. Charts are presented to provide for rapid determination of choking flow for the choking point condition and for Fanno and isentropic flow for the fluids H_2, N_2, O_2, CCl_2F_2, and CCl_3F. A discussion of choking flow and relaxation phenomena is included. Author

N64-32072 Avco-Everett Research Lab., Everett, Mass.

MEASUREMENT OF THE FREE-BOUND AND FREE-FREE CONTINUA OF NITROGEN, OXYGEN AND AIR

R. A. Allen, A. Textoris, and J. Wilson Sep. 1964 30 p refs
(Avco-Everett Res. Note-486)

Measurements have been made of the equilibrium radiation behind incident and reflected shocks produced in an electric arc-driven shock tube over a temperature range of 8000° to 14 000° K. Experiments are described that used a tungsten photoelectric gage to make photometric measurements in the vacuum ultraviolet. Data were also obtained of the continua at 0.51μ in nitrogen, oxygen, and air, which gave information on the component of the radiation produced by electrons being captured by ions and neutral atoms. The measurements agree well with free-bound calculations assuming a hydrogenlike model for N and O. Measurements were also obtained in the infrared at 6.1μ in air over a range of shock conditions that infer a product of an effective Z^2 and Gaunt factor of 1.5 for the air constituent free-free transitions. Author

N64-32135 Polytechnic Inst. of Brooklyn, N.Y.

INSTABILITY OF THREE ROW VORTEX STREETS

Chee Tung Aug. 1963 20 p refs
(Grant WBG-12)
(PIBAL-784; AD-421560)

The steady solution of three row vortex streets with equal spacing between two adjacent vortices in the same row is shown to be of a standard configuration with arbitrary ratio of the spacing to the distance between one pair of the streets. It is shown that for any ratio such configurations are always unstable. When the strength of vortices in one row vanishes and the requirement of stability of motion of the vortices with

zero strength is dropped, the steady configuration of the remaining two vortices is stable and becomes the Karman vortex street. Author

N64-32137 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
MOTION OF A THIN WING NEAR THE FREE SURFACE OF A LIQUID [RUKH TONKOGO KRILA POBLIZU VIL'NOYI POVERKHNI RIDINI]
A. N. Panchenkov Sept. 1963 15 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 8, no. 4, 1962 p433–442
(DTMB-Transl.-316; AD-421868)

A new method is described for the approximate solution of integral equations that arise in research on the problem of the motion of a thin wing near the free surface of a liquid. The intensity of the distribution of eddies is defined in the form of a series. The values of γ_0('s), γ_1('s),....., γ_6)'s) and the formula for the lifting force are given for two special cases—a plane plate and a circular arc profile. Author

N64-32141 General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
TRANSITION OF HYPERSONIC BOUNDARY LAYER
H. T. Nagamatsu, B. C. Graber, and R. E. Sheer, Jr. 28 Jul. 1964 26 p refs
(Contracts AF 04(694)-222; AF 04(694)-486)
(Rept.-64SD855; AD-443707)

An investigation was conducted in a hypersonic shock tunnel to study the boundary layer on a highly cooled 10° cone of 4-ft length. An impact pressure survey of the various types of boundary-layer flows was made at 34.5 in. from the cone tip. The free-stream conditions at this location for Mach number and stagnation temperature were approximately 10° and 1400° K, respectively. The tunnel operating conditions and cone-tip configurations were combined such that laminar, transition, and turbulent flows were obtained at the 34.5-in. location. The impact pressure data was reduced to velocity, temperature, and density profiles for comparison. Surface heat transfer results were also obtained at approximately 34.5 in. from the cone tip, along with schlieren photographs of the boundary layers. All three types of information showed that the various boundary-layer flows actually existed. Author

N64-32176 Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
ANALYSIS OF THE LAMINAR BASE FLOW REGION BEHIND SHARP RE-ENTRY BODIES
Gerald R. Guinn Aug. 1964 84 p refs
(Contract DA-01-021-AMC-85(Z))
(TN-R-110; AD-605399)

The laminar base flow analysis was used to calculate the flow behind conical reentry bodies. The method of Hansen was used to obtain the equilibrium properties of air, and a perfect gas model was used to simulate the "frozen" air properties. The two air models resulted in a difference is base recirculation volume by as much as 150% for a typical reentry situation. Author

N64-32178 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
GENERAL RESEARCH: BOUNDARY LAYERS IN ROTATING FLOWS
Nicholas Rott and W. S. Lewellen 4 Sep. 1964 56 p refs
(ATN-64(9227)-6; AD-605413)

A survey of work on rotating boundary layers on axisymmetric bodies is given. Exact similarity solutions are discussed, and the limits for which the effects of transverse pressure gradient and curvature become predominant are noted. A general momentum-integral solution for both laminar and turbulent flow is presented, using a simplified form obtained from the generalization of similarity properties to include shear laws applicable in turbulent flow. The interaction of the boundary layer and the outer flow is discussed and solved for some examples of enclosed flows. Implications of such an interaction for certain aspects of the tornado problem are noted. Author

N64-32194 Kraichnan (Robert H.), Peterborough, N.H.
DIAGONALIZING APPROXIMATION FOR INHOMOGENEOUS TURBULENCE Research Report No. 5
Robert H. Kraichnan Mar. 1964 27 p refs
(Contract Nonr-4307(00))
(AD-601159)

An approximation for shear and Boussinesq turbulence is introduced, which can greatly lessen the computational task associated with spatial inhomogeneity. It yields statistical equations for inhomogeneous flow, which are of simplicity comparable to the direct-interaction equations for homogeneous flow. The new approximation presupposes a representation of the turbulent fields by expansion in some appropriate set of orthonormal functions that obey the boundary conditions. The covariances that are off-diagonal in the chosen representation, as well as the triple correlations, are approximated in terms of diagonal covariances and diagonal average response functions by a procedure resembling the direct-interaction scheme. The final equations involve only the mean-field amplitudes and the diagonal covariance and response functions. Author

N64-32219 California U., Berkeley Inst. of Engineering Research
RECENT EXPERIMENTAL AND THEORETICAL EXTENSIONS OF NEARLY FREE MOLECULAR FLOW
G. J. Maslach, D. Roger Willis, S. Tang, and D. Ko 22 Jun. 1964 22 p refs
(Contract Nonr-222(45); Grant NSF-GP-13802)
(AS-64-11; AD-603440)

New cylinder and flat strip drag data for models normal to the flow have been obtained utilizing free jet testing techniques. For the drag of a cylinder or of a two-dimensional strip the data have been obtained for sufficiently high Knudsen numbers and with sufficiently low scatter to provide a test of theoretical predictions. Theoretical results obtained from the first iterate method, using a modified Krool model to represent the collision process, and determining the mean free path from viscosity in the gas far from the body, are in reasonable agreement with experimental data for cylinder, two-dimensional strip, and sphere drag. P.V.E.

N64-32234 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOME EFFECTS RELATED TO THE MULTICOMPONENT NATURE OF GAS MIXTURES
N. A. Amfinov 24 Jul. 1964 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr., no. 5, 1963 p 117–123
(FTD-TT-64-198/1+2; AD-605498)

Considered is a gas at rest consisting of molecules that, on dissociation, break down into two particles with essentially different coefficients of diffusion. In this case the presence of a temperature gradient leads to the separation of the dissociation

products. Also considered is the flow past an impenetrable surface of a mixture of two extraneous gases, one of which consists of 2-atom molecules that can dissociate into atoms. The difference in the diffusion coefficients of the separate components leads to a diffusion breakdown of the mixture of gases. The results of the numerical solution for air, considered as a gas of three components, O, O_2 and N_2, are presented. Analogous results are presented for five-component air, taking into account nitrogen and nitrogen oxide. Author

N64-32372 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
NON-EQUILIBRIUM RADIATION
John L. Kulander Jun. 1964 122 p refs
(R64SD41; AD-605827)

The criteria specifying the conditions for which a gas will be in a state of local thermodynamic equilibrium are discussed for both collisionally and radiatively controlled transition processes. Particular emphasis is given to the radiation field in a gas where the particle translational distribution functions are Maxwellian. A microscopic formulation of the transfer equation and solution for the source function is presented for a general n level atom where the first resonance line is optically nonthin. Specific solutions are given for a 3-level atomic model. The calculation of the radiative and collisional cross sections and transition rates is discussed. The bound–bound and bound–free rates are calculated for the lower lying states of NI-VII assuming equilibrium distribution functions for temperatures between 10^4 and $10^{6\circ}$ K. The electron densities and temperatures for which the various collisional and radiative rates are balanced are presented as an indication of situations where the gas (N) will not be in a state of local thermodynamic equilibrium. Author

N64-32384* Denver U., Colo.
IONIZATION CROSS SECTIONS FOR NEUTRAL HELIUM ATOMS ON HELIUM, NEON AND NITROGEN
N. G. Utterback Amsterdam, N. Holland, 1964 Repr. from Atomic Collisions Processes, Proc. of the 3rd Intern. Conf. on the Phys. of Electron. and Atomic Collisions, London, 22–26 Jul. 1963 p 661–665 refs
(Grant NsG-50-60)

The ionization cross sections for He atoms on impact with He and Ne atoms and N_2 molecules have been measured over the laboratory energy range from 40 to 1000 eV. The incident atomic beam was produced by the technique of ionization by electron impact, electrostatic acceleration, and neutralization by charge transfer. The measurements were carried out in a low-pressure parallel plate ionization chamber. Particular attention was paid to the problem of secondary electrons. The ionization cross sections obtained for the He-He and He-Ne interactions were smaller than 5×10^{-17} cm^2 over the energy range studied, and were thus one to two orders of magnitude smaller than the N_2-N_2, N_2-O_2 and O_2-O_2 cross sections studied earlier. The He-N_2 cross section, on the other hand, was found to be of the same order of magnitude as the N_2-N_2 cross section. Author

N64-32386* Advisory Group for Aeronautical Research and Development, Paris (France)
RECENT FREE-FLIGHT BOUNDARY-SURFACE AERODYNAMIC NOISE MEASUREMENTS
I. E. Garrick, D. A. Hilton, and H. H. Hubbard (NASA. Langley Res. Center) Apr. 1963 47 p refs
(AGARD-467)

This report contains a review of recent measurements of fluctuating pressures due to airflow over surfaces. Included are data from aircraft, missiles, and space vehicles for wide ranges of dynamic pressure and Reynolds number for both subsonic and supersonic speeds. Several sources of turbulence that result in severe vehicle loads and vibration environments are discussed, including results for surface flow conditions of developed boundary-layer turbulent flows and others for buffeting types of flow. Also included is brief mention of recent information on the large-scale turbulence characteristics of the atmosphere. Correlations based on free-stream dynamic pressure are presented for a variety of flow conditions, including flow separation and possible shock-wave interactions. Author

N64-32388 Aeronautical Research Associates of Princeton, Inc., N.J.
ENERGY AND MOMENTUM EXCHANGE BETWEEN NON-EQUIPARTITION GASES
T. F. Morse Feb. 1963 31 p refs
(Contract Nonr-3623(S-7); Proj. Squid)
(ARAP-45; AD-602886)

The energy and momentum relaxation of the components of a nonequipartition gas mixture is considered. For the case where each component of the mixture has a Maxwellian distribution at a particular temperature, with the peculiar velocity in the Maxwellian measured relative to the species diffusion velocity, and a "diffusion" Mach number not too large, the results have a particularly simple form. The calculations were carried out for the hard sphere, Coulomb, and Maxwell force laws of interaction. These results may be used to construct approximate kinetic model equations for the case of hard sphere and Coulomb interaction, in a manner similar to that proposed by Sirovich. Author

N64-32405* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ON THE USE OF SINGLE TOTAL- AND STATIC-PRESSURE PROBES TO MEASURE THE AVERAGE MASS VELOCITY IN THIN RECTANGULAR CHANNELS
Joseph M. Savino and Andrew J. Hilousky Washington, NASA, Oct. 1964 12 p refs
(NASA-TN-D-2212) OTS: $0.50

The object of the experiment was to relate the average mass velocity in thin rectangular channels and the velocity sensed by a single fixed total-pressure probe in combination with a fixed static-pressure probe or a wall tap. Two total-pressure probes and one static-pressure probe with outside diameters of 0.025, 0.050, and 0.050 inch, respectively, were tested individually in the center region of the cross section near the outlet of a thin rectangular channel 0.116 by 2.62 inches in cross section and 30 inches in length. The relation between the velocity indicated by the probes and the average velocity of the fluid over the channel cross section was determined for a range of Reynolds numbers from 3600 to 58 000 and for a variety of positions of the total-pressure probe from the surface of the broad walls. The flow at the channel outlet for this Reynolds number range was turbulent and fully developed. Author

N64-32436* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
CESIUM-CESIUM CROSS SECTION AND THE LENNARD-JONES PARAMETERS
John W. Sheldon Washington, NASA, 1964 5 p refs Presented at the Thermionic Conversion Specialist Conf., Cleveland, 26–28 Oct. 1964
(NASA-TM-X-52060) OTS: $1.00 fs; $0.50 mf

The values of the Lennard–Jones parameters used by Robinson in his computation of the transport properties of cesium vapor are used to compute the cesium-cesium total scattering cross section. The result gives good agreement with beam experiments. Author

N64-32458 General Dynamics/Pomona, Calif.
TURBULENT FLOW AND HEAT TRANSFER NEAR SURFACE PROTUBERANCES
H. Dershin Dec. 1963 91 p refs
(Contract NORD-16840)
(CR-3; TM-349-127; AD-448755)

The problem of two-dimensional, supersonic, turbulent flow on a plate upstream of a surface protuberance is considered within the framework of the Crocco–Lees mixing theory. Engineering methods are presented that can be used to calculate the pressure distribution upstream of a step that extends beyond an adiabatic boundary layer. These are based on newly derived equations for the mixing rate coefficients very close to the point of separation and rely on empirical variations of this parameter elsewhere. Heat transfer is considered at the point of turbulent separation. Equations are derived that successfully predict the perturbations over ordinary flat plate heat transfer due to separation. Author

N64-32463 General Dynamics/Convair, San Diego, Calif.
FORCE AND SPRAY CHARACTERISTICS OF WING END PLATES PENETRATING THE WATER SURFACE
W. B. Barkley Apr. 1964 66 p refs
(GD/C-64-100; AD-449216)

Hydrodynamic force tests have been conducted with thin plates having differing profile geometry representative of wing end plates and GEM side skegs and center keels. The configurations of the plates differ in leading-edge rake angle and leading-edge sharpness. Tests were conducted over a range of depths of submergence and angles of pitch, roll, and yaw. Lift, drag, and side forces were measured during constant velocity runs in smooth water and in one wave size. The resulting data are presented in coefficient form as an aid to the designers of wing end plates, side skegs, and vertical keels. Author

N64-32496 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE INFLUENCE OF DEPOSITS IN TUBES ON HYDRAULIC PRESSURE DROP
Wilhelm Wiederhold 15 Sep. 1964 26 p refs Transl. into ENGLISH from Z. Deut. Ver. Gas Wasserfachmänner (Berlin), v. 90, no. 24, 1949 p 634–641
(RSIC-269; AD-606777)

In pressure sections of a long-distance water pipeline, considerable decreases in the rate of flow that occurred in years of low operation were traced back to a special corrugation of the film of grease deposited in the system. The small depth of the deposit in relation to the pipe diameter and its technical flow behavior indicated that it was a new specific type of roughness. A discussion of this peculiar roughness phenomena is given. It was concluded that the ripples found on the surface of this small deposit were responsible for the disproportionate reduction in flow (as much as from 52 liters/sec to 32 liters/sec). Methods developed for cleaning the pipeline in question are also discussed. P.V.E.

N64-32526* Denver U., Colo.
EFFECTS OF ION BEAM EXCITATION ON CHARGE TRANSFER CROSS SECTION MEASUREMENTS
R. C. Amme and N. G. Utterback Amsterdam, N. Holland, 1964 Repr. from Atomic Collision Processes, Proc. of the 3rd Intern. Conf. on the Phys. of Electron. and Atomic Collisions, London, 22–26 Jul. 1963 p 847–853 refs
(Grant NsG-50-60)

The charge transfer cross sections for N_2^+ and O_2^+ ions in N_2 have been measured both as a function of ion energy and ion source electron energy. Ion energies were varied between 40 and 100 eV, and the ion source electron energy was varied between 16 and 24 eV. The resonant N_2^+ in N_2 cross section varied as a function of ion energy in the manner generally reported by other investigators. However, the cross section decreased 15% in going from 17 to 23 eV in electron energy. This is attributed to metastable ions in the beam, which transfer inefficiently. In the O_2^+ in N_2 case, for electron energies below 18 eV, the cross section vs. ion energy curve was strongly nonresonant, approaching zero cross section below 100 eV. For electron energies above 22 eV, a transfer cross section was quite evident that appeared to have resonance form. The metastable states likely to produce these results are discussed along with their estimated transfer cross sections. Author

N64-32567 Carnegie Inst. of Tech., Pittsburgh, Pa.
UNCONVENTIONAL METHODS FOR INFLUENCING FLUID FLOW. VOLUME II: THE THERMOMOLECULAR EFFECT WITH APPLICATIONS TO ENERGY CONVERSION
George Anthony Mc Lennan Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Nov. 1963 96 p refs
(Contract AF 33(657)-9914)
(ASD-TDR-63-776, Vol. II; AD-427745)

The phenomenon of the thermomolecular pressure rise in a gas, which occurs across a capillary material by virtue of a temperature difference, has been analyzed in several energy conversion devices that are by nature thermodynamically irreversible. Large temperature differences have been considered. The effects of heat transfer through the capillary material and a potential energy work function have been included. Three different heat engine cycles were analyzed requiring different thermodynamic processes, and the maximum efficiency was determined for various imposed temperature differences, treating heat transfer and the work function separately. The efficiency of a single device was compared to that of a cascade of similar devices operating over the same temperature difference. Author

N64-32570 Carnegie Inst. of Tech., Pittsburgh, Pa.
UNCONVENTIONAL METHODS FOR INFLUENCING FLUID FLOW, VOLUME I
J. F. Osterle et al Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Nov. 1963 130 p refs
(Contract AF 33(657)-9914)
(ASD-TDR-63-776, Vol. I; AD-427769)

A number of related problems concerning the utilization of unconventional effects for the purpose of affecting the behavior of fluids are investigated. Effects capable of directly converting thermal or electrical power into pumping power without the use of moving mechanical parts are studied. Means of improving the thermoelectric cooling of liquids, decontaminating fluids by an electrical effect, and suppressing pressure surges in flowing fluids are examined. Author

N64-32589 Wisconsin U., Madison
ISOTHERMAL AND NON-ISOTHERMAL FLOW OF NON-NEWTONIAN FLUIDS IN TUBES
R. Byron Bird Oct. 1963 16 p refs Submitted for Publication
(Rept.-22; AD-443551)

A summary is given of the application of generalized Newtonian models to the calculation of the velocity and temperature profiles for non-Newtonian fluids in circular tubes. From the latter, the friction factors and Nusselt numbers can also be calculated. Most of the discussion is centered on the Ellis model, a three-parameter equation that has been found to be generally useful for describing the behavior of polymers and polymer solutions. Author

N64-32599 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF RIEMANN METHOD TO SOLUTION OF PROBLEM OF FLOWING AROUND OF THIN BODIES
N. M. Monakhov 21 May 1964 14 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 4, 1962 p 27–35
(FTD-MT-63-288; AD-449228)

The flow around thin bodies revolving at a small angle of incidence is considered. Potentials of perturbations of longitudinal and transverse flows are obtained with accuracy up to values of the fifth and fourth orders of smallness relative to the thickness of the body. The determination of each potential is reduced to the solution of one integral equation of the Abel type and not to a system of differential equations as was formerly done. A.W.

N64-32603 Space Technology Labs., Inc., Redondo Beach, Calif.
A MODEL FOR THE CALCULATION OF RADAR BACKSCATTER FROM UNDERDENSE HYPERSONIC TURBULENT WAKES
W. H. Webb 8 Jun. 1964 21 p refs
(Contract AF 04(694)-440)
(STL-6433-6005-KU-000; BSD-TDR-64-85; AD-449234)

The consequences of assuming self-preservation for a hypersonic turbulent wake are examined. Estimates of turbulent fluctuations and scale lengths for slender and blunt bodies are given, and a model for the calculation of underdense radar backscatter is suggested. Author

N64-32644* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONTE CARLO SOLUTIONS OF KNUDSEN AND NEAR-KNUDSEN FLOW THROUGH INFINITELY WIDE, PARALLEL AND SKEWED, FLAT PLATES
James O. Ballance 20 Aug. 1964 32 p refs
(NASA-TM-X-53112) OTS: $2.00 fs; $0.50 mf

This study presents the results of an investigation of Knudsen flow and near-Knudsen flow through infinitely wide, parallel, and skewed flat plates. Monte Carlo computer techniques were used. Two simple models for considering molecule–molecule interactions, as well as molecule–surface interactions, were used to examine the near-Knudsen flow regime. Transmission probabilities for various length-to-entrance ratios and for various angles of skewness are presented. The influence of mean free path and length-to-entrance ratios on Knudsen flow determination is discussed. Author

N64-32656 Northrop Corp., Hawthorne, Calif. Norair Div.
RESEARCH ON LOW DRAG BOUNDARY LAYER CONTROL APPLICATION OF LAMINAR FLOW CONTROL TECHNOLOGY TO OPTIMUM SUPERSONIC CRUISE Progress Report, 15 Apr.–15 Jun. 1964
Jun. 1964 20 p refs
(Contracts AF 33(657)-10792; AF 33(657)-11618)
(NOR-64-142; AD-449604)

The program for calculating the downwash distribution and thickness effects has been checked out on a constant-chord infinite swept wing, and it was found to give satisfactory results. This was then applied to a tapered swept wing of large span. Further tests were performed on the FORTRAN program designed to obtain the proper solutions of the Orr–Sommerfeld system with sufficient accuracy and economy for applying the resonance theory of transition. An analysis of the possible reduction in sonic boom through the use of L.F.C. indicates that the parameters of greatest interest are h (the altitudes of the aircraft), S_{max} (its maximum cross-sectional area), and L_{tot} (its total left). A.W.

N64-32657 Aerospace Corp., El Segundo, Calif. Space Physics Lab.
PHOTOIONIZATION AND ABSORPTION CROSS SECTIONS OF O_2 AND N_2 IN THE 600 TO 1000 Å REGION
G. R. Cook and P. H. Metzger 12 Aug. 1963 47 p refs
(ATN-63(9218)-4; AD-449610)

Absolute photoionization and absorption cross sections of O_2 and N_2 have been measured in the 600 to 1000Å region using a 1-meter Seya scanning vacuum ultraviolet monochromator with a resolution of 0.5Å in the first-order and the Hopfield continuum-background light source. A path length of 40.6 cm was used with simultaneous detection of ion current and photon flux. The absolute photon flux was determined by calibrating the ion chamber with the rare gases A, Kr, and Xe. In O_2, the spectrum at longer wavelengths consisted of band absorption superimposed on a continuum, and, in the short wavelength region, by the continuum alone. Many of the bands were diffuse, and absorption coefficients were independent of pressure. In N_2, the spectrum showed many closely spaced narrow absorption bands down to about 750Å, broad pre-ionized bands of the Hopfield Rydberg series to about 670Å, and a smooth ionization continuum at shorter wavelengths. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-31376 Air Force Cambridge Research Labs., Bedford, Mass.
PROJECT FIREFLY, 1962–1963 Environmental Research Papers No. 15
N. W. Rosenberg, ed. May 1964 436 p refs
(AFCRL-64-364; AD-602078)

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18. IONOSPHERIC WIND PATTERNS THROUGH THE NIGHT N. W. Rosenberg and H. D. Edwards (Ga. Inst. of Tech) p 341–350 refs (See N64-31394 23-12)

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N64-31377 Air Force Cambridge Research Labs. Bedford, Mass.

PROJECT FIREFLY, 1962–1963: A SUMMARY REPORT

N. W. Rosenberg and D. Golomb *In its* Proj. Firefly, 1962–1963 May 1964 p 1–19 refs (See N64-31376 23-12)

The general objective of Project Firefly was to study the dynamics, transport processes, state, composition, and artificial perturbations of the upper atmosphere. For the studies, a technique is employed wherein various chemicals are released in the upper atmosphere from rocketborne containers, followed by observations from the ground of the effects of the release. A discussion is presented of ground-based instrumentation—optical, radio-frequency, and acoustic. A brief summary is presented of the results obtained in relation to experiments involving the following: (1) electron clouds; (2) electron holes; (3) artificial luminescence—fluorescence of trimethyl aluminum, luminescence of nitric oxide, acetylene glow, miscellaneous luminous releases (nitrogen dioxide, carbon disulfide, ammonia, sodium); and (4) explosive releases—optical and acoustic studies of high altitude explosions, radio-frequency studies of high-altitude explosions. P.V.E.

N64-31378 Air Force Cambridge Research Labs., Bedford, Mass.

PAYLOAD COMPOSITIONS AND RELEASE SYSTEMS

N. W. Rosenberg, E. F. Allen, Jr., and A. W. Berger *In its* Proj. Firefly, 1962–1963 May 1964 p 21–40 refs (See N64-31376 23-12)

Details on chemical compositions, conditions and thermodynamic calculations of Firefly payloads are reported. Release system engineering features are described. Statistics of successes and failures are given. Author

N64-31379 Georgia Inst. of Tech., Atlanta

PHOTOGRAPHIC AND PHOTOMETRIC OBSERVATIONS OF CHEMICAL RELEASES, DATA REDUCTION, INTERPRETATION AND ANALYSIS

Howard D. Edwards *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 41–89 (See N64-31376 23-12)

Horizontal wind velocities have been computed for 5 of the twilight releases and for 14 night releases that took place during Firefly III. Data are presented that give the wind heading in degrees east of north, magnitude of wind speed in meters per second, and north–south and east–west components in meters per second. Plots of north–south and east–west components are also given for each rocket release. Author

N64-31380 Device Development Corp., Weston, Mass.
PHOTOGRAPHY AND PHOTOMETRY FROM LUMINOUS CHEMICAL RELEASES
R. B. Holt *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 91–159 (See N64-31376 23-12)
(Contract AF 19(628)1642; ARPA Order 42; Proj. Defender)

A major new approach to the problem of the interpretation and analysis of photo-optical and other types of data gathered during the Project Firefly series of vertical probe launches has been initiated. These new techniques involve the use of electronic data processing methods and equipment. Essentially all of the organization and planning of the electronic data processing approach to this problem has been completed. Data have been extracted from films obtained during a number of Firefly experiments and have been converted into computer input forms. Several analytical programs have been written that manipulate the raw data and present them in printed form in response to several different lines of experimental investigation. Author

N64-31381 Georgia U., Athens
SPECTROGRAPHY AND SPECTROMETRY OF LUMINOUS CHEMICAL RELEASES
C. Dewey Cooper *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 161–170 (See N64-31376 23-12)

The spectrographic and spectrometric data obtained from Project Firefly have been studied, and those that appeared to be the most promising for furnishing intensity measurements were processed to provide such information. The equipment used, calibration, and data reduction techniques are discussed. Author

N64-31382 Stanford Research Inst., Menlo Park, Calif.
STUDIES OF RF SCATTERING PROCESSES FROM IONIZED CHEMICAL RELEASES IN THE UPPER ATMOSPHERE
D. R. Allison and W. G. Chesnut *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 171–223 (See N64-31376 23-12)

This report describes the results of converting field data stored on magnetic tape into a visual format. The field data (on magnetic tape) contain recordings of radar backscatter and forward scatter signals reflected from chemical releases in the E- and F-regions. The conversion of these data into 'Z-scope' format is the first step in the data analysis. This report presents the data from events FANNY and GILDA, nighttime and sunlit F-region probes, respectively. Also included are the data from releases KITTY (cesium release at 108 km in sunlight) and DANA (aluminum-doped high explosive at 101 km altitude). Author

N64-31383 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
IONOSONDE STUDIES OF CHEMICAL RELEASES
J. W. Wright *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 225–254 refs (See N64-31376 23-12)

A description is presented of ionosonde observations obtained during the release of chemicals and high explosive detonations in the E- and F-regions of the ionosphere. Several experiments were designed to reduce locally the ambient electron density. The effects are discussed in comparison with the calculated ambient electron distributions. Author

N64-31384 National Bureau of Standards, Boulder, Colo.
SPACED RECEIVER DRIFT RESULTS
Garth H. Stonehocker and E. Harnishmacher (Ionospharen-Inst.) *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 255–258 (See N64-31376 23-12)

Studies of the motion of electron clouds using spaced ionosondes indicated agreement with the optically observed motions during the early visible phase of the cloud lifetime, and disclose meaningful and consistent movements for periods up to several hours later. It was of interest to know if the drift measured by this technique pertained to wave motion in the medium or to mass transport. Observations were obtained that permitted approximate values for the drift speed and direction to be obtained essentially by inspection of the recordings in cases where the drift itself is reasonably steady. Data in tabular form are presented that show the estimated values of the cloud-drift-vector direction and drift speed for various electron cloud experiments. P.V.E.

N64-31386 Air Force Systems Command, Eglin AFB, Fla.
INFRARED RADIOMETER MEASUREMENTS
D. J. Edwards *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 267–270 (See N64-31376 23-12)

Two infrared radiometers, one in the near infrared, the other covering a wide region, were used to measure infrared radiation from a TMA and CS_2 release. An unexpected and unexplained result was that the TMA cloud emitted less ir energy than the equivalent area of clear sky, implying that the cloud was cooler than the background. Author

N64-31387 Air Force Cambridge Research Labs., Bedford, Mass.
FORMATION OF AN ELECTRON DEPLETED REGION IN THE IONOSPHERE BY CHEMICAL RELEASES
D. Golumb, N. W. Rosenberg, J. W. Wright (Natl. Bureau of Standards), and R. A. Barnes (Stanford Res. Inst.) *In* its Proj. Firefly, 1962–1963 May 1964 p 271–284 refs (See N64-31376 23-12) Repr. from Space Res. (Amsterdam), v. 4, 1964

The formation of an electron-depleted region in the ionosphere on release of a chemical with a high attachment coefficient for free electrons is reported. About 10^{26} molecules of sulfur hexafluoride were released from a rocket-borne

pressurized tank at 220-km altitude. Marked perturbations were observed on sweeping and pulsed radio-frequency sounders, which can be interpreted as resulting from an electron-depleted region as predicted by Booker. The frequencies returned from the region were initially in the 7- to 9-Mc/sec band, later spreading to cover the 4- to 8-Mc/sec band, indicating a growth of the electron-depleted region. The effect lasted for about 30 minutes. Author

N64-31388 Air Force Cambridge Research Labs., Bedford, Mass.

SPACE AND TIME VARIATIONS OF ELECTRON DENSITIES IN AN IONOSPHERIC HOLE

D. Golomb and W. J. B. Oldham, Jr. *In its* Proj. Firefly, 1962–1963 May 1964 p 285–290 refs (See N64-31376 23-12)

A physical model and the equations for the space and time variation of electron densities within an electron-depleted region are described. The equations include the effect of the geomagnetic field on the diffusion of charged particles. The full equations have to be solved by a computer. For a simplified set of equations an analytical solution is obtained that gives useful information on the kinetic and dynamic behavior of the ionospheric hole. Author

N64-31389 Air Force Cambridge Research Labs., Bedford, Mass.

IONOSPHERIC WINDS AND SPORADIC E CORRELATIONS

N. W. Rosenberg, H. D. Edwards (Ga. Inst. of Tech.), and J. W. Wright (Natl. Bureau of Standards) *In its* Proj. Firefly, 1962–1963 May 1964 p 291–307 refs (See N64-31376 23-12) Repr. from Space Res. (Amsterdam), v. 4, 1964

The persistence of night winds and shears for more than 5 hours after sunset at altitudes between 100 and 150 km was evaluated during the COSPAR synoptic ionospheric winds program. The method used was to release chemiluminous trails from rockets. The release times were, respectively, 13 minutes before sunset at the 100 km level, and 28 minutes, 4 hours 12 minutes, and 5 hours 12 minutes after sunset.

Author

N64-31390 Air Force Cambridge Research Labs., Bedford, Mass.

WIND SHEAR THEORY OF SPORADIC E

Malcolm A. Mac Leod *In its* Proj. Firefly, 1962–1963 May 1964 p 309–321 refs (See N64-31376 23-12)

Equilibrium electron-density profiles have been obtained for wind-shear-induced layers of ionization in the lower E-region by assuming a constant-shear neutral wind profile and neglecting the effect of diffusion. A comparison of the maximum electron densities predicted with those observed when simultaneous observations of sporadic E and wind shears were made gives order-of-magnitude agreement. The theoretical model appears to have the capability of explaining the formation of certain types of sporadic E-layers. Author

N64-31391 Air Force Cambridge Research Labs., Bedford, Mass.

CHEMILUMINESCENT TECHNIQUES FOR STUDYING NIGHTTIME WINDS IN THE UPPER ATMOSPHERE

N. W. Rosenberg, D. Golomb, and E. F. Allen, Jr. *In its* Proj. Firefly, 1962–1963 May 1964 p 323–327 refs (See N64-31376 23-12) Repr. from J. Geophys. Res., v. 68, 1963 p 3328

Two different types of payload for generating persistent, glowing trails under full night conditions have recently been designed and flown, and their effectiveness has been evaluated. The first type of payload is based on the chemiluminescent reactions of vaporized aluminum and/or its oxides with the atomic oxygen of the upper atmosphere. The second type is based on the chemiluminescent reaction of atomic oxygen with nitric oxide. Experiments carried out using the two payloads are discussed. P.V.E.

N64-31392 Air Force Cambridge Research Labs., Bedford, Mass.

CHEMILUMINESCENCE OF TRIMETHYL ALUMINUM RELEASED INTO THE UPPER ATMOSPHERE

N. W. Rosenberg, D. Golumb, and E. F. Allen, Jr. *In its* Proj. Firefly, 1962–1963 May 1964 p 329–334 refs (See N64-31376 23-12) Repr. from J. Geophys. Res., v. 68, 1963 p 5895

An experiment using 1100 g of liquid trimethyl aluminum (TMA) to study upper-atmosphere chemiluminescence is discussed. The TMA was released at 94-km altitude. An intensely luminous cylindrical trail about 20-km long developed along the rocket trajectory, with maximum diameters of 2 km at 7 sec, 3 km at 22 sec, and 7 km at 100 sec. Photographic methods for triangulation of the cloud permitted the determination of diffusion, turbulence, and wind data. It is concluded that the high photon yield of TMA and the simplicity of providing a trail release make TMA an excellent material for synoptic measurements of ionospheric winds, shears, turbulence, and diffusion constants. P.V.E.

N64-31393 Air Force Cambridge Research Labs., Bedford, Mass.

RESONANCE RADIATION OF AlO FROM TRIMETHYL ALUMINUM RELEASED INTO THE UPPER ATMOSPHERE

N. W. Rosenberg, D. Golomb, and E. F. Allen, Jr. *In its* Proj. Firefly, 1962–1963 May 1964 p 335–339 refs (See N64-31376 23-12) Submitted for Publication

An experiment involving the release of trimethyl aluminum (TMA) at twilight, so that the trail was sunlit but the sky background was dark, is discussed. The reaction mechanism for the TMA-oxygen interaction was studied by spectroscopy of the resonance radiation from reaction products or intermediate species. AlO bands were observed in the sunlit part of the trail. Observations discussed include the following: (1) The sunlit spectrum displays the blue-green AlO bands of the transition of $A^2\,\Sigma^+$ to $X^2\,\Sigma^+$. (2) The banded spectrum does not appear below 130-km altitude, although the solar horizon at the time of exposure was at the 110-km level. (3) The spectrum of the low (chemiluminescent) trail is continuum. P.V.E.

N64-31394 Air Force Cambridge Research Labs., Bedford, Mass.

IONOSPHERIC WIND PATTERNS THROUGH THE NIGHT

N. W. Rosenberg and H. D. Edwards (Ga. Inst. of Tech.) *In its* Proj. Firefly, 1962–1963 May 1964 p 341–350 refs (See N64-31376 23-12) Presented at the 5th Conf. on Appl. Meteorology, Atlantic City, 1964

Four measurements (two on winter nights and two on summer nights) of winds and shears in the ionosphere are reported, and correlations of wind motions with altitude, time and season are examined. The discussion is summarized as follows: (1) Horizontal ionospheric winds in the 90- to 150-km altitude region veer (rotate clockwise viewed from above) with increasing altitude at all times of the night, both winter and summer. (2) Individual components of wind show a sinusoidal pattern at any given time of night. (3) A downward phase velocity is present throughout the night between 100 to 130 km, with a downward velocity of about one wavelength per 12-hour night. (4) In a given zone (region between two nulls), horizontal winds either increase or decrease throughout the night. (5) At any given altitude in the 100- to 130-km region, winds veer with time at a rate of about one cycle per 12-hour night (somewhat more at the lower altitude, and somewhat less at the higher altitudes). P.V.E.

N64-31395 University Coll., London (Gt. Brit.)
ACOUSTIC PULSE CHARACTERISTICS FROM EXPLOSIVE RELEASES IN THE UPPER ATMOSPHERE
G. V. Groves *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 351–364 refs (See N64-31376 23-12)

Calculations have been made of the main characteristics of a pressure pulse arriving at the ground from an explosive release in the upper atmosphere at heights between 20 and 180 km and for energies of 10^{11} to 10^{15} ergs. The quantities derived are the maximum pressure amplitude, the length of the positive pressure phase, the travel-time shortening due to the finite-amplitude of the wave, and the effect of neglecting this on temperature determination. Author

N64-31396 Air Force Cambridge Research Labs., Bedford, Mass.
IONOSPHERIC TEMPERATURES FROM PHOTOGRAPHY OF DETONATIONS
N. W. Rosenberg *In its* Proj. Firefly, 1962–1963 May 1964 p 365–374 refs (See N64-31376 23-12) Submitted for Publication

The overpressure in the shock wave accompanying the detonation of a high-explosive grenade at 108-km altitude was found to increase the brightness of a chemiluminous trail deposited just prior to the detonation. Motion of the bright overpressure region along the trail was photographed with a ground-based streak camera. The shock-wave motion agreed with the calculations of Brode, and corresponded to an ambient sound speed of 350 m/sec. This speed is equivalent to a molecular scale temperature of 300° ±50° K, compared with the U.S. Standard Atmosphere value of 250° K. Author

N64-31397 Air Force Cambridge Research Labs., Bedford, Mass.
SMALL-SCALE WIND STRUCTURE ABOVE 100 km
Samuel P. Zimmerman *In its* Proj. Firefly, 1962–1963 May 1964 p 375–378 refs (See N64-31376 23-12) Repr. from J. Geophys. Res., v. 69, 1964 p 784

Sodium trail releases, covering the altitude range of 80 to 160 km, are analyzed. The method of analysis used is the one developed by Hines in estimating the minimum scale size of atmospheric gravity waves. This method (Hines) takes into consideration the variations from the mean of the wind velocity magnitudes that are observed in visible meteor trails at altitudes between 80 and 100 km. Data representing winter and summer components of the wind are considered. From 100 to 125 km, the small-scale limit of Hines showed a relationship to the measured data value of the minor modes. However, at about 130 km, for the summer data, there appeared to be an abrupt transition of the nodal sizes from Hines limit to a value proportional to the atmospheric-pressure scale height. P.V.E.

N64-31398 Air Force Cambridge Research Labs., Bedford, Mass.
PROPAGATION BY HIGH ALTITUDE CHEMICAL PLASMA RELEASES
N. W. Rosenberg and D. Golomb *In its* Proj. Firefly, 1962–1963 May 1964 p 379–391 refs (See N64-31376 23-12) Repr. from Ions and Electrons in Combust. Systems, AIAA Ser., v. 12, 1963

Physical or chemical techniques can be used to form localized regions of high electron density in the upper atmosphere. One method is described in detail wherein a mixture of cesium nitrate, aluminum powder, and a high explosive is detonated in the 90- to 120-km altitude region of the upper atmosphere. The partially ionized reaction products expand to form a cloud from which radio waves can be reflected or scattered. In night releases, the free electrons are generated in the explosion by thermal ionization; in day releases additional photoionization of cesium occurs by absorption of solar uv. The reflected radio signal duration and intensity are dependent on altitude, time of day, and wind shears. In addition to thermal ionization and photoionization, major factors in determining the usefulness of chemical plasma clouds for radio-wave propagation are their size, structure, and orientation with respect to the transmission path. Author

N64-31399 Geophysics Corp. of America, Bedford, Mass.
A SYSTEMATIC STUDY OF HYDROCARBON MISSILE EXHAUST REACTIONS WITH ATMOSPHERIC CONSTITUENTS
Neville Jonathan and G. Doherty *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 393–407 refs (See N64-31376 23-12) Repr. from AMIRAC Proc.
(Contract AF 19(628)-231)

Details are given of the performance of a laboratory apparatus designed for the simulation of the conditions that give rise to the light emission from missile trails during the boost and early postboost phases. Successful attempts to obtain measurements of the light emission from chemical reactions down to 8μ Hg are described. Particular reference is made to the light-emitting reactions of carbon monoxide and acetylene with atomic oxygen. A method is also given whereby atomic oxygen concentrations may be accurately measured at low pressures. Author

N64-31400 AeroChem Research Labs., Inc., Princeton, N.J.
CHEMI-IONIZATION PROCESSES IN THE INTERACTION OF MISSILE EXHAUST PRODUCTS WITH ATMOSPHERIC CONSTITUENTS
A. Fontijn *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 409–423 refs (See N64-31376 23-12)

The upper atmospheric enhancement of rocket exhaust ionization is briefly discussed. A probable cause of this phenomenon is the occurrence of the reaction $CH + O \rightarrow CHO^+ + e^-$. It is yet to be established whether the CH involved in this reaction is in its ground electronic state or in an excited state. Reasons are given to explain why this reaction may lead to a less diffuse ionization trail when it occurs in rocket exhaust gases than when it occurs due to upper atmospheric acetylene releases. A laboratory research program based on the reaction $O + C_2H_2$ is outlined, the goal of which is to fully elucidate the reaction mechanism and to quantitatively determine the efficiency of processes leading to upper atmospheric chemi-ionization. The work is carried out in a Wood-Bonhoeffer-type flow system and involves the measurement of ion concentration, light emission intensity, and the concentration of reactants and reaction products. Author

N64-31401 Mithras, Inc., Cambridge, Mass.
GASDYNAMIC ANALYSIS OF THE NITRIC OXIDE TRAIL EXPERIMENT
Jacques A. F. Hill and Henry L. Alden *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 425–445 refs (See N64-31376 23-12)

A gas-dynamic analysis has been made of the flow generated by the release of NO from a supersonic vehicle in the upper atmosphere. The initial mixing between the NO and the ambient is found to occur in a layer forming approximately a paraboloid surrounding the vehicle. In this layer, the actual mixing zone is sandwiched between two shockwaves. For one actual experiment, a calculation has been made of the size and shape of the mixing layer and of the amount of ambient entrained. With increasing altitude it is found that the mixture changes from being at first rich to finally lean in NO. Author

N64-31532 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALYTICAL REPRESENTATION OF THE EARTH'S MAGNETIC FIELD IN THE ORBITAL COORDINATE SYSTEM
A. D. Shevnin *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 193–202 refs (See N64-31522 23-29)

Formulas are derived for expressing the magnetizing-force components of the earth's constant magnetic field as a function of time, and of the elements of an elliptical orbit in terms of the orbital system of coordinates. The coordinate system considered for the orbit system was one in which the positive direction of the X-axis is geographical north; the positive direction of the Y-axis is east; and the positive direction of the Z-axis is vertically downward. Procedures for calculating the magnetizing force components of the earth's magnetic field in the orbital coordinate system are also discussed. P.V.E.

N64-31533 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GEOGRAPHICAL DISTRIBUTION OF RADIATION INTENSITY IN THE REGION OF THE BRAZILIAN MAGNETIC ANOMALY AT AN ALTITUDE OF ABOUT 300 km
S. N. Vernov, V. Ye. Nesterov, I. A. Savenko, P. I. Shavrin, and K. N. Sharvina *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 203–213 refs (See N64-31522 23-29)

Discussed is the geographic distribution of radiation intensity in the region of the Brazilian magnetic anomaly according to the data from the Kosmos-7 and Kosmos-15 satellites. The distribution obtained is compared with the results of measurements made on the satellites Kosmos-3 and Kosmos-5, as well as on the satellite Discoverer 31. Author

N64-31534 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF TERRESTRIAL RADIATION BELTS IN THE VICINITY OF THE BRAZILIAN MAGNETIC ANOMALY AT ALTITUDES OF 235–345 km
S. N. Vernov, V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, O. I. Savun et al *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 214–223 refs (See N64-31522 23-29)

Results of an investigation of the terrestrial radiation belt in the vicinity of the Brazil magnetic anomaly, carried out with the Kosmos-IV, Kosmos-VII, Kosmos-IX, and Kosmos-XV satellites, by means of Geiger and scintillation counters are discussed. It was established that the intensity of radiation in the region rises sharply as a result of the descent of the inner radiation belt to low altitudes. The magnetizing force of the field in the Brazil anomaly is small, and at an altitude of 300 km has a value below 0.22 gauss, which is equivalent to an altitude of 1500 km for the same magnetic shell along other longitudes. The lifetime of the electrons in the artificial radiation belt was measured, and it was found that for magnetic shells with $L < 1.8$, the lifetime diminishes from values of 4 months with $B = 0.23$ gauss and $L = 1.25$ to 1.4, to 20 days with $B = 0.265$ gauss and $L = 2$. P.V.E.

N64-31550* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN AUTOMATED MODEL FOR PREDICTING THE KINETIC TEMPERATURE OF THE AEROSPACE ENVIRONMENT FROM 100 TO 60,000 KILOMETERS ABOVE THE SURFACE OF THE EARTH
Robert E. Smith 10 Aug. 1964 21 p refs
(NASA-TM-X-53104) OTS: $1.00 fs; $0.50 mf

This paper describes the derivation of a series of equations capable of predicting the kinetic temperature of the aerospace environment from 100 to 60 000 km above the surface of the earth. The equations, which are programed on a GE 225 computer, can be used to predict temperature–height profiles for any time through December 1992. Author

N64-31571* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE UNITY AND ORIGIN OF THE AUSTRALIAN TEKTITES
Dean R. Chapman Repr. from Geochim. Cosmochim. Acta, v. 28, 1964 p 841–880 refs
(NASA-RP-343)

Aerodynamic experiments with tektite glass demonstrate that, subsequent to the termination of ablation, high thermal stresses are formed within a thin outer shell. This shell spontaneously spalls, leaving a core shaped like many of the tektites found in Billiton, Java, Philippines, and Australia. Certain tektite fragments from Java and Australia are shown to have the same internal stress patterns as pieces of aerothermal stress shell. The overall evidence indicates that the Australasian tektites descended into the atmosphere as rigid objects of glass. Core shapes found in the extreme southwest part of Australia surprisingly are more like those found in the Philippines than in other areas of Australia; comparisons of chemical analyses and of specific gravity population polygons reveal the same striking circumstances. It is concluded that all Australasian tektites represent a single event. The effect of turning on the determination of entry trajectories is discussed, and new evidence is presented pertaining to the deceleration that existed when ablation terminated on the australites. The trajectory determinations correspond to an origin from the moon. Author

N64-31624 Atomic Energy Commission, New York, N.Y. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Jun. 1964–1 Sep. 1964
Edward P. Hardy, Jr. and Joseph Rivera 1 Oct. 1964 75 p refs
(HASL-149) OTS: $2.75

Radionuclide levels in fallout, worldwide soils collected in 1963–64, milk, tap water, and upper air samples are given in tabular form. Also included are interpretive reports and notes dealing with strontium-90 levels in the diets and bones of Argentine children and of San Juan, Puerto Rico residents; cesium-137, stable strontium, and radium-226 in two human skeletons; latitudinal deposition of strontium-90 in the United States; a statistical analysis of the 1963–64 soils analytical data; and expected and measured plutonium-238 concentrations in air from a satellite failure. A bibliography of recent literature pertinent to fallout studies is given at the end of the report. Author

N64-31630 California Research Corp., La Habra
ANALYSIS OF A PROGRAM FOR COMPUTING THEORETICAL SEISMOGRAMS FOR MULTILAYERED MEDIA Scientific Report No. 5
Donald P. Squier 14 Apr. 1964 49 p refs
(Contract AF 19(604)-8344; ARPA Order 180-61)
(AFCRL-64-503; AD-443717)

The numerical computation of the response to a compressional point-source in a layered elastic medium underlying a vacuum is considered. If both liquids and solids are present, any liquid layer is above every solid layer. The basic idea is to compute the double Fourier transforms of stresses and displacements by the matrix method and then to obtain the real-time functions by double integration of the transforms. The difficulty of Rayleigh poles is circumvented by integrating over those phase velocities exceeding the shear (compressional) velocity in the solid (liquid) half-space. The necessary formulas were programed in FORTRAN for the IBM 7094. It is concluded that this method is not very satisfactory, for the enormous jumps in the transforms require that they be computed at about one million points in the plane of integration. Author

N64-31735 International Business Machines Corp., Cambridge, Mass.
ATMOSPHERIC DENSITY DETERMINATION FROM SATELLITE OBSERVATIONS Final Report
R. J. Greenfield, J. P. Rossoni, and P. Sconzo Feb. 1964 147 p refs
(Contract AF 19(628)-1600)
(AFCRL-64-543; AD-606698)

The atmospheric density at perigee height is computed from satellite observations by the following procedure: (1) obtaining accurate orbital elements from a differential orbit correction procedure; (2) fitting each element as a function of time; (3) analyzing the residuals in mean anomaly; (4) computing the rate of change of the anomalistic period; and (5) deriving the density by integrating Sterne's formula considering a Jacchia's model atmosphere. The data processing technique is given more emphasis than the analytical formulation in this attempt at an automatic procedure for the computation of atmospheric density. Author

N64-31736 Kiruna Geophysical Observatory (Sweden)
AN INVESTIGATION OF THE HEIGHT OF SCINTILLATION-PRODUCING IRREGULARITIES Scientific Report No. 7
Ludwik Liszka 12 Jul. 1964 14 p refs
(Contract AF 61(052)-678)
(AFCRL-64-741; AD-606646)

The present paper gives a summary of scintillation height measurements made at Kiruna, Sweden. Heights obtained are compared with simultaneous results of vertical soundings and geomagnetic activity. Author

N64-31737 Kiruna Geophysical Observatory (Sweden)
A STUDY OF THE SCINTILLATION-RATE SPECTRUM OBSERVED IN THE AURORAL ZONE Scientific Report No. 9
Ludwik Liszka 20 Jul. 1964 16 p refs
(Contract AF 61(052)-678)
(AFCRL-64-743; AD-606648)

A study of the scintillation-rate spectrum of satellite signals at 54 Mc/sec observed at Kiruna, Sweden, is presented. Temporal variations in the scintillation-rate spectrum, in particular the occurrence of slow and fast scintillation, are investigated. Author

N64-31776 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PORTABLE NEUTRON GENERATORS IN NUCLEAR GEOPHYSICS
S. I. Savosina, ed. 29 Jul. 1964 243 p refs Transl. into ENGLISH of the book "Portativnyye Generatory Neytronov v Yadernoy Geofizike" Moscow, Gos. Izd. Lit. v Obl. At. Nauki i Tekhn., 1962 p 1–204
(FTD-MT-63-283; AD-605567)

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N64-31777 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NEUTRON GENERATORS IN NUCLEAR GEOPHYSICS

F. A. Alekseyev *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 1-9 (See N64-31776 23-12)

A brief history of the development and refinement of neutron generators for geophysical applications is presented. The basic advantages of pulse neutron-neutron logging techniques over logging with continuous neutron-flux sources are indicated, and present and potential applications of pulse generators in oil wells and coal and ore shafts are discussed. M.P.G.

N64-31779 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SNIG-2 NEUTRON PULSE GENERATOR FOR GEOLOGICAL EXPLORATION

D. F. Bespalov, B. G. Yerozolimskiy, Yu. N. Parkhomenko, and A. I. Khaustov *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 24-36 (See N64-31776 23-12)

The design and operation of a pulse neutron generator, SNIG-2, that was successfully field tested in investigations of petroleum and gas wells by pulse neutron-neutron electrical core sampling methods are reported. The generator is a pulse source of 14-MeV neutrons, having an average intensity of up to 10^7 neutrons/sec with pulse duration of 50 to 100 microseconds and a frequency of 400 cps. A thermal neutron recorder is included in this SNIG-2 model. M.P.G.

N64-31781 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TUBES FROM THE FIRM "SCHLUMBERGER" FOR ELECTRICAL CORE SAMPLING OF PETROLEUM WELLS

A. H. Frentrop and G. Sherman *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 45-53 (See N64-31776 23-12)

General characteristics, design, accelerating gap, pressure control, ion source, target, neutron yield, continuous operation, pulse operation, and lifetime are discussed for Schlumberger tubes for electrical core sampling of petroleum wells. M.P.G.

N64-31783 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MINIATURE SEALED-OFF PULSE NEUTRON TUBE

L. R. Voytsik and B. G. Yerozolimskiy *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 60-73 refs (See N64-31776 23-12)

A miniature sealed pulse neutron tube suitable for work in oil wells is described. The tube is manufactured easily by using conventional technological processes, and the average neutron yield (10^7 neutrons/sec) is adequate for carrying out geophysical measurements using radioactive logging methods. M.P.G.

N64-31787 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FHYSICAL BASES OF PULSE NEUTRON-NEUTRON LOGGING

Yu. S. Shemelevich and A. S. Shkol'nikov *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 115–131 refs (See N64-31776 23-12)

The physical bases of pulse neutron-neutron logging discussed include these: (1) neutron properties of rocks and the space–time distribution of thermal neutrons; and (2) application of pulse neutron-neutron logging to problems of determining the location of water–oil and gas–liquid contact in a bed, as well as the nature of the fluid saturating the bed. M.P.G.

N64-31789 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE QUESTION OF THE INFLUENCE OF THE HYDROGEN CONTENT OF A MEDIUM ON A PNNL READING

B. M. Burov and V. P. Odinokov *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 137–140 refs (See N64-31776 23-12)

Tests of model sand beds with various hydrogen contents intersected by an encased well were conducted to establish the possibilities of the pulse neutron-neutron logging method for calculating the hydrogen content of rocks and also to determine the influence of diffusion on the $N(t)$ curve, where N is the number of readings and t is the delay time. The results show that oil-bearing beds can give larger readings in comparison to dense rocks containing less hydrogen. This phenomenon is apparently connected with the great influence of diffusion at short distances from the source. M.P.G.

N64-31790 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

LABORATORY EXPERIMENTS ON THE APPLICATION OF A PULSE NEUTRON SOURCE IN WELL LOGGING

G. Tittman and V. Nelligan *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 141–149 (See N64-31776 23-12)

Gamma radiation is formed in the following two ways during the existence of a neutron from the moment of emission from the target to its disappearance in rock: (1) inelastic collisions of a neutron, when it still has high speed, with nuclei of rock; and (2) as the result of radiative capture of a neutron after it has slowed to thermal speeds. Continuous-action neutron generators do not permit separation of the spectra due to each of these gamma-emission mechanisms, whereas pulsed operation of the generator, together with appropriate scintillator operation, permits resolution of inelastic-scattering and radiative-capture spectra. Oxygen and carbon lines can be detected in the inelastic-scattering spectra; hydrogen, silicon, and chlorine can be detected in the radiative-capture spectra. Development of instrumentation and results of laboratory tests are discussed. M.P.G.

N64-31791 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

APPLICATION OF METHODS OF INELASTIC SCATTERING OF NEUTRONS AND INDUCED RADIOACTIVITY FOR SINGLING OUT CARBON CONTENT OF BEDS AND APPRAISAL OF THEIR QUALITY

N. V. Popov *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 150–168 refs (See N64-31776 23-12)

Discussions are presented of the following: (1) results of laboratory tests of the possibilities of detecting carbon, oxygen, and silicon in oil or coal beds; (2) applications of pulse-neutron generators; (3) applications of a pulse regime of gamma-radiation registration of radiative capture of thermal neutrons; and (4) the application of activation analysis for detecting oxygen and silicon. The most promising technique appears to be a complex use of pulse methods (inelastic scattering, induced activity, and radiative capture of thermal neutrons in 1 cycle of measurements by a single instrument). M.P.G.

N64-31792 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

USE OF A NEUTRON GENERATOR

A. Yumans and S. Zimmerman *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 169–177 (See N64-31776 23-12)

Instruments for nuclear logging are described; the most promising developments using neutron generators are reviewed; and their applications for oil logging by the method of activation of activation of oxygen nuclei are discussed. M.P.G.

N64-31793 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE SPACE-TIME DISTRIBUTION OF THERMAL NEUTRONS IN MODEL SAND LAYERS

V. V. Miller *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 178–180 (See N64-31776 23-12)

The space–time distribution of thermal neutrons in a sandy, uniform medium with about 5% moisture was studied using a pulse-neutron generator. The results confirm the influence of diffusion of thermal neutrons on their spatial distribution. With increased time delay t, the neutrons occupy an even greater space, and the zone investigated by pulse neutron-neutron logging is increased. M.P.G.

N64-31794 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technicology Div.

RESULTS OF THE APPLICATION OF A PULSE NEUTRON GENERATOR FOR DETERMINATION OF THE WATER–OIL CONTACT IN THE FIELDS OF TATARIYA

Ye. B. Blankov and F. A. Kurilenko *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 181–186 (See N64-31776 23-12)

Tests using the pulse neutron-neutron logging (PNNL) method in six perforated and two nonperforated drowned wells were conducted in order to determine the position of the water-oil contact. The results for all the nonperforated wells confirmed the sensitivity of the PNNL method over other radiometric methods, and results were obtained for the more difficult cases of determining the water–oil interface in flooded wells in Devonian sandstone and carboniferous strata, where all previous methods had failed. The tests also revealed the possibility of layered media studies in cased wells in a manner similar to lateral sound logging in uncased wells. M.P.G.

N64-31795 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE QUESTION ON THE INTERPRETATION OF THE RESULTS OF THE PULSE NEUTRON-NEUTRON LOGGING
D. M. Srebrodol'skiy *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 187–208 refs (See N64-31776 23-12)

Methods of interpreting the results of neutron methods of logging are discussed. The main advantage of pulse neutron-neutron logging (PNNL) is the possibility of the quantitative determination of one parameter of the rocks—the lifetime of thermal neutrons. However, the following factors influence the results and must be accounted for: (1) the geometric dimensions of the field source; (2) the geometric dimensions of the PNNL probe; (3) well diameter; (4) zone of penetration of the boring liquid into the penetrated layers; (5) cement ring; and (6) casing pipes. The reliability of PNNL results is considerably increased by the inclusion of data from other geophysical methods of investigating wells. Electric logging data are especially useful, since the lifetime of thermal neutrons studied by PNNL methods and the electric resistance of the rocks studied by electric logging both depend upon the degree of mineralization of the layer ores, the main component of which, for the great majority of petroleum and gas deposits, is NaCl. M.P.G.

N64-31796 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF STATISTICAL TESTS IN APPLICATION TO CALCULATION OF DISTRIBUTION OF NEUTRONS IN PROBLEMS OF NEUTRON LOGGING
S. A. Denisik, R. A. Rezvanov, and B. Ye. Lukhminskiy *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul 1964 p 209–236 refs (See N64-31776 23-12)

The application of the Monte Carlo method for calculating the delay and diffusion of neutrons in problems of neutron logging is described. The variant of the Monte Carlo method used is discussed, followed by methods of obtaining the flow of random numbers, the emission of the neutron from the source, the neutron path to collision, plotting neutron energy after collision, direction of neutron motion after collision, direction cosines of neutron after *n* collisions in a motionless system of coordinates, plotting a multilayer cylindrical medium, and a block diagram of a program for calculating the distribution of neutrons. This method permits the calculation of the space–time and power distribution of neutrons in media of relatively complicated geometry. Results obtained for water, quartz, and sandstone are discussed, and the problem of the distribution of neutrons from an anisotropic source is considered. M.P.G.

N64-31805 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
GEOMETRY AND FIRST-ORDER ERROR STATISTICS FOR THREE- AND FOUR-STATION HYPERBOLIC FIXES ON A SPHERICAL EARTH Physical Science Research Paper No. 29
Edward A. Lewis Jun. 1964 94 p refs
(AFCRL-64-461; AD-605816)

Certain fundamental geometric properties of hyperbolas and ellipses on the surface of a sphere are developed. A first-order theory is then presented for the random errors in the location of a point on a spherical earth, by the intersection of spherical hyperbolas physically determined by a time difference technique in which the individual errors are "normally" distributed and uncorrelated. Two cases are treated: (1) four time-measuring stations working as two independent pairs; and (2) three time-measuring stations working on a common time base. In both cases, the contours of equal error probability density are shown to be ellipses, and their properties are discussed. In both cases the distribution of radial error without regard to direction is given by a generalized distribution function that contains the Rayleigh distribution as a special case. Using the general form, the most probable mean, root mean square, and median radial errors are obtained. Author

N64-31806 Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.
SHEAR DEFORMATION OF UPPER MANTLE MINERAL ANALOGUES: TESTS TO 55 kb AT 27° C Environmental Research Papers No. 30
R. E. Riecker and K. E. Seifert Jul. 1964 28 p refs
(AFCRL-63-619; AD-606118)

Shear deformation of upper mantle mineral analogs forsterite, enstatite, diopside, and labradorite at 27° C temperature, 5- to 55-kb average pressure, and at strain rates from 1 sec^{-1} to 10^{-3} sec^{-1} indicates that all minerals have high average shear strengths. Shear strength for North Carolina and Hawaiian olivine is 15.17 kb at 50-kb average pressure. Average shear strength for Madagascar diopside and Labrador labradorite are 14.90 kb to 14.03 kb and 13.15 kb, respectively, at 50-kb average pressure. Each shear-stress–normal-pressure curve is resolvable into two regions of constant but different slopes separated by a broad transitional knee. These represent separate and distinguishable behavior. The predominant behavior at all pressures is cataclastic; intragranular flow becomes significant only at high pressures. Violent snapping accompanies rotation at 27° C and relates to surficial stick-slip between sample and pistons. All snapping ceases at 300° C. Author

N64-31823 Georgetown U., Washington, D.C. Georgetown Coll. Observatory
RESEARCH DIRECTED TOWARD REFINEMENT OF GEODETIC TECHNIQUES UTILIZING TERRESTIAL AND SPATIAL CONFIGURATIONS Final Report
Francis J. Heyden 21 Jul. 1964 10 p
(Contract AF 19(628)-2491)
(AFCRL-64-699; AD-605952)

The total eclipse of the sun on July 20, 1963, was observed near Ellsworth, Maine. Clouds interfered with the principal experiments, but partial success was obtained by two methods for determining the time of mid-totality. Only the photoelectric data have been reduced for this report. Author

N64-31828 , Ohio State U. Research Foundation, Columbus Inst. of Geodesy, Photogrammetry and Cartography
THE PREDICTION OF POINT AND MEAN GRAVITY ANOMALIES THROUGH THE USE OF A DIGITAL COMPUTER Scientific Report No. 9.
Richard H. Rapp Jun. 1964 182 p refs *Its* Rept. No. 43
(Contract AF 19(628)-2771)
(AFCRL-64-575; AD-605949)

The least squares predictions of point anomalies have been carried out in two distinct areas of the United States. The statistical quantities needed for their use in the prediction equations of Moritz were computed using some 32 000, 5 × 5 ft mean anomalies. The mean anomalies and their accuracies in these two areas were predicted in 5 × 5 ft and 30 × 30 ft squares. Computer programs written for the IBM 7094 were used in these computations. Author

N64-31884 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE MECHANISM OF GEOMAGNETIC EFFECTS OF MAJOR EXPLOSIONS
A. F. Kovalevskiy 24 Jun. 1964 11 p refs Transl. into ENGLISH from Tr. Siberskogo Fiz.-Tekhn. Inst., pri Tomskom Gos. Univ. (USSR), no. 41, 1962 p 87–91
(FTD-MT-64-266; AD-602401)

On the basis of similarity between effects of nuclear explosions and of the explosion of the Tungus meteorite in 1908, a hypothesis is expressed on the similarity of mechanisms for qualitatively different explosions. The following mechanism of the geomagnetic effect of nuclear explosions is proposed: Immediately after explosion over an area with a radius of 3000 to 4000 km, there develops a heightened ionization that creates conditions favorable for the propagation of hydromagnetic impulse. The first phase of perturbation is caused by this impulse. The second or main phase is caused by the action of the shock wave. Lowering of field and its subsequent restoration are associated with displacement of currents with respect to the observation stations and their gradual damping. Author

N64-31990 Ohio State U. Research Foundation, Columbus Inst. of Geodesy, Photogrammetry, and Cartography
ON FREE AIR ANOMALIES ESTIMATED FROM DIFFERENT MODELS Scientific Report No. 8
Erwin Groten May 1964 28 p refs */ts* Rept. No. 42
(Contract AF 19(628)-2771)
(AFCRL-64-574; AD-605360)

From mean free air anomalies of 124 5° × 5° squares as observed on the Northern Hemisphere, the accuracy of model anomalies for different models is tested. Only mean elevations are used in the evaluation of topographic effects. Author

N64-31991 Ohio State U. Research Foundation, Columbus Inst. of Geodesy, Photogrammetry, and Cartography
ON GRAVITY REDUCTIONS Scientific Report No. 10
Erwin Groten Jul. 1964 30 p refs */ts* Rept. No. 44
(Contract AF 19(628)-2771)
(AFCRL-64-576; AD-605950)

Bouguer's and isostatic methods for the evaluation of gravity anomalies on the earth's physical surface are discussed. Errors involved in the reduction of gravity down to sea level are compared for condensation, isostatic, and Rudzki's anomalies. The connections between gravity anomalies at the earth's surface and on the geoid are discussed. Author

N64-31992 Boston Coll., Chestnut Hill, Mass. Ionospheric Research Lab.
DETERMINATION OF THE DRIFT DIRECTION AND VELOCITY OF IONOSPHERIC WINDS OVER PUERTO RICO Scientific Report No. 1
Margaret E. Gardner 1 Sep. 1964 37 p
(Contract AF 19(628)-4178)
(AFCRL-64-603; AD-606200)

The computer program described was developed from a method that analyzes ionospheric wind data automatically upon reception to obtain drift direction and velocity. It is a method based essentially on the concept of similar fades. The results presented are obtained from E-layer reflections over Puerto Rico for the years 1958–1959. Author

N64-31993 High Altitude Observatory, Boulder, Colo. National Center for Atmospheric Research
DYNAMICS OF THE UPPER ATMOSPHERE Final Report
Bernhard Haurwitz and Julius London 31 Jul. 1964 24 p refs
(Contract AF 19(604)-5488)
(AFCRL-64-612; AD-605916)

On the basis of the total-ozone measurements a marked longitudinal variation of the total-ozone distribution related to the circulation pattern in the lower and middle stratosphere has been demonstrated. Further, it has been found that the variation of the range of annual ozone distribution is largest where the average ozone values are largest, namely in the Northern Hemisphere. The daily total ozone amounts during the strong stratospheric warmings of January–February 1958 showed a strong tendency to increase in the region of the largest temperature rises at the 25-mb surface. Numerical calculations of the nonequilibrium diurnal ozone variations in the mesosphere have shown that there is a marked increase of ozone during the night and an immediate decrease at sunrise. Theoretical calculations of simple models of thermally driven circulations have been made to study the nonlinear effect of the temperature advection term. Author

N64-31994 Pennsylvania State U., University Park Ionosphere Research Lab.
A STUDY OF HIGH LATITUDE IONOSPHERIC CURRENT PATTERNS—WITH EMPHASIS ON THE 12TH HOUR U.T.
D. H. Fairfield 20 Aug. 1964 47 p refs
(Contract AF 19(628)-4014; Grant NSF-G-18983)
(AFCRL-64-637; SR-217; AD-606644)

The conventional DS current pattern is shown to be always a good first approximation to the actual currents, but day-to-day and seasonal variations are appreciable. Average current vectors with variational ellipses are shown, and variations with season and intensity are illustrated. The average current across the polar cap is shown to flow about 30° west of the sun direction in the summer but 65° west in the winter. A study of various UT hours shows this seasonal variation to be present at all hours but with greatest magnitude for UT between 12 and 16. Evidence is presented showing that the high-latitude electrojet occurs at higher latitudes on the day side of the earth than on the night side, as do aurora and trapped particles. Author

N64-32014 Universidad Autonoma de San Luis Potosi (Mexico) School of Engineering
GROUNDED ELECTRODES FOR ELECTRICAL CONNECTIONS [ELECTRODOS A TIERRA PARA CONEXIONES ELECTRICAS]
J. Jaime Valle Mendez (Ph.D. Thesis) Sep. 1964 110 p refs In SPANISH

Subjects considered include atmospheric electric discharges and the necessity of having grounding electrodes, electrical resistance of the grounding electrodes, and different types of ground electrodes. Methods of measurement of electrical resistance of ground electrodes are discussed, as is the composition of the soil and its resistivity, together with the variation of the resistivity of the soil with humidity and temperature. The electrical resistance of a system of ground electrodes is treated as a function of the number of electrodes and of their depth, and different types of lightning arrestors and dividers are considered. Protection against atmospheric electric discharges is discussed for buildings, chimneys, antennas, transmission lines, etc., as is the grounding of electrical power distribution equipment. D.E.W.

N64-32020 International Geophysical Year World Data Center C2, Tokyo (Japan)

COSMIC-RAY INTENSITY DURING THE POST INTERNATIONAL GEOPHYSICAL COOPERATION, NO. 8: BI-HOURLY NEUTRON AND MESON INTENSITY, JANUARY 1–DECEMBER 31, 1961

Oct. 1963 157 p

Data of cosmic-ray intensities obtained in the Japanese five stations during 1961 are presented here. They consist of 16 components and were compiled in the same form as preceding issues. The data are obtained by means of two neutron monitors from Showa Base and Mt. Norikura, four ion chambers from Mt. Norikura, Sapporo, Itabashi, and Mabashi, a counter telescope from Itabashi, and a plastic scintillation detector from Showa Base. Author

N64-32130 Joint Publications Research Service, Washington, D.C.

NONADIABATIC FACTORS IN SHORT-TERM FORECASTING OF LOWER-ATMOSPHERE GEOPOTENTIAL FIELDS

V. S. Purganskiy 8 Oct. 1964 11 p refs Transl. into ENGLISH from Tr. Tsentral. Inst. Prognozov (Moscow), no. 126, 1963 p 47–54

(JPRS-26792; TT-64-51049) OTS: $1.00

Presented is a method for solving the problem of predicting the geopotential in the lower atmosphere in a quasi-geostrophic approximation, with allowance for the inflow of heat due to radiation and turbulent thermal conductivity. Author

N64-32184 Air Force Cambridge Research Labs., Bedford, Mass.

HORIZONTAL AND VERTICAL DISTRIBUTIONS OF ATMOSPHERIC DENSITY, UP TO 90 km Air Force Surveys in Geophysics No. 157

Allen E. Cole and Arthur J. Kantor Jun. 1964 31 p refs

(AFCRL-64-483; AD-605196)

Estimates of seasonal, latitudinal, day-to-day, and diurnal variations in the horizontal and vertical distribution of atmospheric density are provided for altitudes up to 90 km. The rates of decay of interlevel correlations with layer separation for the region 48 to 70 km are compared to those computed for levels between 12 and 26 km. The day-to-day variability in height of constant density surfaces is also examined with special emphasis on levels near 8 km, approximate location of the well-known isopycnic level. Author

N64-32199 California U., Berkeley General Electric Co., Valley Forge, Pa.

A THEORY OF RAYLEIGH WAVES BASED ON A VISCO-ELASTIC-PLASTIC MODEL OF EARTH'S CRUST AND MANTLE

Paul Lieber and K. T. Yen (GE Co.) Oct. 1963 33 p refs Presented at the Intern. Union of Geodesy and Geophys. Meeting, Berkeley, Calif., Aug. 1963 under title "On the Propagation, Dispersion, and Attenuation of Rayleigh Waves for a Maxwell Body"

(Contract Nonr-222(87))

(MD-63-4; AD-605551)

The scope of a comprehensive investigation relating to the inelastic constitution of the earth is outlined and includes a theory on Rayleigh waves in a Maxwell body. The mathematical development leading to the conditions of admissibility of harmonic Rayleigh waves propagating in a Maxwell body is presented. The results show that effects pertaining to period selectivity, attenuation, and dispersion are obtained for a Maxwell body, which cannot, in principle, be accounted for by an elastic theory of Rayleigh waves. A.W.

N64-32205 Ludwig-Maximilians-Universitat, Munchen (W. Germany) Meteorologisches Inst.

INVESTIGATION OF THE INFRARED EMISSION SPECTRUM OF THE ATMOSPHERE AND EARTH Final Report

Hans-Jürgen Bolle, Günter Kuers, Fritz Moller, and Heinrich Quenzel 15 Mar. 1964 107 p refs

(Contract AF 61(052)-488)

(AFCRL-64-567; AD-603089)

Presented is an optical method to determine the total water-vapor content of the atmosphere with an interference-filter actinograph. The diminution of the solar radiation within near-infrared water-vapor bands in comparison with pure aerosol extinction at reference wavelengths is used as a measure of the water-vapor mass. The accuracy of the water-vapor determination depends on the influence of selective atmospheric absorption on the reference filters, on the wavelength dependence of the continuum extinction coefficient, and on the pressure- and temperature-dependence of the water-vapor absorption. This report also deals with a radiometer instrumentation for infrared radiation measurements from a helicopter. This instrument is for use in the 2μ to 3.5μ region in order to investigate the influence of haze on the atmospheric radiation field near the ground. Author

N64-32244 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE CAUCASUS

A. A. Zanina 30 Jun. 1964 312 p refs Transl. into ENGLISH of the book "Kavraz" Leningrad, Gidrometeorol. Izd., 1961 p 1–290

(FTD-MT-63-336; AD-605580)

Presented are the characteristics of the main climate-forming force components of the earth's magnetic field in the orbital general characteristics of the climate of the Caucasus and a description of its separate elements (heat, wind conditions, humidity conditions, atmospheric phenomena), and also climatic regionalization of the Caucasus and the climatic characteristics of its separate regions. Author

N64-32255* Texas Western Coll., El Paso Schellenger Research Labs.

GRENADE EXPLOSIONS IN THE UPPER ATMOSPHERE

J. G. Pruitt *In* AERDA Atmospheric Acoust. Propagation [1964] p 1–12 refs (See N64-32254 23-23)

(Contract NAS5-2949)

Waves recorded from rocket grenade experiments were investigated. In the grenade experiment, a rocket is fired containing 12 grenades. The grenades are ejected and exploded as the rocket ascends. The predictions of Landau and others concerning the "N" profile as the characteristic shock-wave profile for an explosion appear to be verified in the recorded signals from the grenade experiments. The results also indicate that the ratio of $(E/P_0)^{1/3}$ (E is the energy of the explosion and P_0 is the ambient pressure) to the wavelength of the recorded "N" is essentially constant. P.V.E.

N64-32264 Denver U., Colo. Denver Research Inst.
THE COUPLING OF IONOSPHERIC AND NEUTRAL ATMOSPHERIC ACOUSTIC WAVES
Robert C. Amme and Harry L. Morrison *In* AERDA Atmospheric Acoust. Propagation [1964] p 187–202 refs (See N64-32254 23-23)

Evidence for the existence of hydromagnetic waves in the ionosphere, ion waves, and ion-wave damping are discussed experimentally and theoretically. From the discussion, it is concluded that there is strong experimental and theoretical evidence for the existence of hydromagnetic and ion acoustic waves in the ionosphere. It is also concluded that low-frequency ion waves, and perhaps the hydromagnetic wave, become rapidly attenuated as β (the ratio of the gas pressure to the "magnetic" pressure) becomes large (i.e., as the neutral density becomes large) at the lower altitudes. The acoustical energy of the ion wave may, under conditions not yet precisely known, excite ordinary sound waves in the neutral gas component. P.V.E.

N64-32291 RCA Service Co., Inc., Patrick AFB, Fla. Optical Systems Data Reduction
RANGE INSTRUMENTATION STATIONS, GENERAL SURVEY DATA
G. T. Mead and B. G. Kirkland Patrick AFB, Fla., AF Missile Test Center, 1 Jul. 1963 38 p
(Contract AF 08(606)-5300)
(AD-442881)

Positions are referenced to the Clarke spheroid of 1886. Most of the positions are on the North American datum of 1927. Positions on the Cape Canaveral datum are identified by asterisks. The range coordinate system is a right-handed cartesian coordinate system referenced to pad 3 in which the positive X-axis is true east and the positive Y-axis is true north. The UDRL designations are expressed in hundreds of feet. The origin is pad 3. The azimuth of U-axis is 307°, 49 min., and 7 sec. The azimuth of D-axis is 127°, 49 min., and 7 sec. The azimuth of R-axis is 217°, 49 min., and 7 sec. The azimuth of L-axis is 37°, 49 min., and 7 sec. Author

N64-32334 Joint Publications Research Service, Washington, D.C.
INTERPRETATION OF THE READINGS OF AN INSTRUMENT MOVING AT A GREAT VELOCITY IN THE HIGH LAYERS OF THE ATMOSPHERE
A. I. Repnev *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 61–72 refs (See N64-32328 23-21) OTS: $4.00

The problems associated with interpreting data obtained from rocket- or satellite-borne instruments are considered. Measured values of atmospheric parameters are affected by gas rarefaction, dissociation, and ionization in the upper layers of the atmosphere. The factors that can cause the pressure, density, and composition of the gas in the instrument to vary from their values in the atmosphere, and the relationships that are used in correcting for these factors are discussed. M.P.G.

N64-32340 Joint Publications Research Service, Washington, D.C.
MEASUREMENT OF SURFACE TEMPERATURE BY THE RADIATION METHOD
V. L. Gayevskiy *In its* Method and Instr. for Meteorol. Observations 6 Oct. 1964 p 129–141 refs (See N64-32328 23-21) OTS: $4.00

Measurement of the radiation temperature of the earth's surface from low-flying aircraft is discussed with particular attention to the sources of measurement errors. For the spectral region from 8 to 12 microns, these errors arise from atmospheric counterradiation reflected from the earth's surface and the air layer between the earth's surface and the infrared detector. Methods of introducing a correction for these errors in the measured values and the estimated accuracy of the corrected values are presented. M.P.G.

N64-32353 Library of Congress, Washington, D.C. Aerospace Information Div.
PHENOMENA IN THE UPPER ATMOSPHERE. COMPILATION OF ABSTRACTS FROM SOVIET LITERATURE
24 Mar. 1964 22 p refs
(AID-P-64-15; AD-601890) OTS: $1.00 fs; $0.50 mf

The following topics are discussed in this paper: "Ionospheric Electron Concentration"; "Solar Radiation and the Ionosphere"; "Van Allen Belts and Cosmic Rays"; "Telluric Currents"; "Nuclear Bursts in the Atmosphere"; and "Satellite and Missile Data." G.G.

N64-32354 Library of Congress, Washington, D.C. Aerospace Technology Div.
PHENOMENA IN THE UPPER ATMOSPHERE Compilation of Abstracts
2 Sep. 1964 32 p refs
(ATD-P-64-51; AD-605327) OTS: $2.00 fs; $0.50 mf

This review of Soviet developments in selected problems in astrophysics and geophysics covers ionospheric electron concentrations, solar radiation and the ionosphere, Van Allen belts and cosmic rays, telluric currents, atmospheric electricity, nuclear bursts in the atmosphere, satellite and missile data, arctic and antarctic communications, and meteorology of the upper atmosphere. It is based on materials received at the Aerospace Technology Division in May 1964. D.E.W.

N64-32368 Illinois U., Urbana Radiolocation Research Lab.
A FORTRAN SUBROUTINE TO DETERMINE THE COMPONENTS OF THE EARTH'S MAGNETIC FIELD AS A FUNCTION OF ALTITUDE AND GEOGRAPHIC COORDINATES FROM A SPHERICAL HARMONIC EXPANSION Technical Note No. 24
Roger A. Vossler Nov. 1963 15 p refs
(Contract Nonr-1834(02))
(RRL Publ.-220; AD-427328)

This program evaluates the northerly, easterly, and vertical components of the earth's magnetic field at a specified height above some designated point on the surface of the earth. The mathematics of the program is derived directly from the spherical harmonic analysis of the earth's magnetic field. It was assumed that the magnetic field is entirely of internal origin, since the external field strength is less than approximately 0.1% of the internal field strength. Because of the more or less general nature of a program of this type, it was decided to organize the program as a general subroutine; in this way the subroutine could be conveniently accessed by both FORTRAN and SPAR. The communication between the control routine and the subroutine is established through the use of common storage shared by both the control program and the subroutine. Author

N64-32385* Georgia Inst. of Tech., Atlanta
A METHOD EMPLOYING STAR BACKGROUNDS FOR IMPROVING THE ACCURACY OF THE LOCATION OF CLOUDS OR OBJECTS IN SPACE

C. G. Justus, H. D. Edwards, and R. N. Fuller Repr. from Photogrammetric Eng., Jul. 1964 p 594–607 refs
(Grant NsG-304)

The position and velocity of clouds or other objects moving through the upper atmosphere are often determined from a study of simultaneous photographs taken from two or more observing stations against a darkened sky with a background of stars. With correction for atmospheric refraction supplied by tables, the star background is utilized to increase the accuracy of camera orientation by correcting errors inherent in the camera system produced by film shrinkage, light refraction in the glass fiducial grid plate, and tilt of the camera with respect to the local horizontal. Techniques and empirical formulas are developed for use in analytic data processing with a digital computer to the order of a thousandth of a centimeter. The final procedure can produce angular position determinations of 0.3 milliradian. A method for accurately determining camera focal lengths is also presented. Author

N64-32392 Columbia U., Palisades, N.Y. Lamont Geological Observatory
BASIC STUDY ON THE OSCILLATION OF A SPHERE. PART V: PROPAGATION OF TORSIONAL DISTURBANCES ON A RADIALLY HETEROGENEOUS SPHERE. CASE OF A HOMOGENEOUS MANTLE WITH A LIQUID CORE Scientific Report No. 27
Y. Sato, T. Usami, M. Landisman, and M. Ewing Sep. 1963 24 p refs Repr. from the Geophys. J. of the Roy. Astron. Soc. (Gt. Brit.), v. 8, no. 1, 1963 p 44–63
(Contract AF 19(604)-7376)
(AFCRL-63-916; AD-442722)

The propagation of an impulsive torsional disturbance excited by a localized stress on the surface of a sphere consisting of a homogeneous mantle surrounding a liquid core is expressed as the sum of normal mode solutions. The formulas presented can be used for the calculation of the disturbance on the surface of a sphere having any arbitrary radial distribution of material. Since the medium is a finite bounded body, the normal modes offer a complete description of the propagating disturbance. The azimuthal component of displacement at various points on the surface is calculated numerically as a function of time by summing the spectral contributions from 360 normal modes equally distributed among the first six radial modes. The surface waves, which are similar to those observed from earthquakes, are caused primarily by the fundamental radial mode, while the body waves are primarily related to the higher radial modes. Author

N64-32443 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
DIURNAL VARIATION OF IONOSPHERIC ELECTRON CONTENT OBTAINED FROM DOPPLER SLOPES OF SIMULTANEOUS SATELLITE SIGNALS
P. R. Arendt and H. Soicher Jul. 1964 22 p refs
(USAEL-TR-2489; AD-606701)

All doppler methods for measuring the electron content using simultaneously emitted rocket or satellite cw signals of different frequencies are based on the assumption that those signals travel toward the observer along nearly identical paths. For satellites, this assumption has not been discussed earlier. It is best met at high elevation; therefore, the data used in this paper are based on the measurement of doppler slopes of high elevation orbits at the points of inflection. Also, the comparison of the observed time moments at which doppler inflection of different frequencies occurs provides a means of selecting only those data that are actually simultaneous. Data selected in accordance with this principle can be evaluated on the basis of straight-line propagation. The actual data describe the diurnal variation of the integrated electron density during November–December 1961. Author

N64-32520 Army Cold Regions Research and Engineering Lab., Hanover, N.H.
PROFILE AND HEAT BALANCE AT THE BOTTOM SURFACE OF AN ICE SHEET FRINGED BY MOUNTAIN RANGES
J. Weertman May 1964 12 p refs
(CRREL Res. Rept.-134; AD-446743)

The profile of an ice sheet fringed by mountain ranges has been found. The calculation is broken down into three parts: determination of the profile of an outlet glacier, determination of the profile on the ice sheet itself of the drainage area at the head of an outlet glacier, and determination of the profile of the central portion of the ice sheet. The main result of this extension of the theory of ice sheet profiles is the conclusion that the profile of an ice sheet is little influenced by the presence of encircling mountains, provided that mature outlet glaciers drain the ice sheet through the mountains. Author

N64-32521 Army Cold Regions Research and Engineering Lab., Hanover, N.H.
BIBLIOGRAPHY ON SNOW, ICE AND PERMAFROST WITH ABSTRACTS, VOLUME XVIII
Frank M. Marson et al Jun. 1964 278 p refs
(CRREL-12, Vol. XVIII; AD-447121)

The bibliography provides current and comprehensive coverage of scientific information about living and operating in the polar regions and cold areas where snow, ice, and permafrost exist. Abstracts are arranged in general subject groups and by number; authors are listed alphabetically; a few titles are listed in alphabetical order; and an extensive subject index with many cross-references is included. D.E.W.

N64-32527* Illinois U., Urbana
F-REGION IRREGULARITIES STUDIED BY SCINTILLATION OF SIGNALS FROM SATELLITES
K. C. Yeh and G. W. Swenson, Jr. Repr. from Radio Sci. J. Res. NBS/USNC-URSI, v. 68 D, no. 8, Aug. 1964 p 881–894 refs
(Grant NsG-24)

The character of the scintillation, and thus, probably, of the ionospheric irregularities that cause them, vary systematically with geomagnetic latitude, season of the year, time of day, and phase of the sunspot cycle. Nighttime scintillation occurs in the F-region, mainly at heights of about 350 km. This type of scintillation in most cases results from first-order scattering from weak, field-alined irregularities in electron density. In the Northern Hemisphere such scintillations are observed north of a certain parallel geomagnetic latitude, the southern limit varying weakly with magnetic activity. Similar effects are also observed in the Southern Hemisphere. Daytime scintillations also show strong seasonal and sunspot-cycle dependence but very little latitude dependence. Strong scintillation occurs simultaneously with the occurrence of red auroral arcs. Author

N64-32566 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
ATMOSPHERIC ATTENUATION OF INFRARED RADIATION OVER SHORT DISTANCES

L. H. Skolnik and E. F. Cross 4 Sep. 1964 38 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-167; TDR-269(4250-11)-3; AD-449197)

This report presents the formulas and data needed to calculate infrared attenuation over short paths in the atmosphere. The problem is rather unique, since most publications dealing with infrared attenuation are concerned with absorption over long atmospheric paths. It is shown that Rayleigh scattering is negligible in the near-infrared spectrum over short paths. Models for calculating narrow-band absorption and empirical formulas of Burch, Howard, and Williams for broadband absorption are also presented. In addition, absolute transmissions for both narrow-band and broadband absorption of water vapor and broadband absorption of CO_2 are given. Author

N64-32639* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MASS SPECTROMETRIC INVESTIGATIONS OF THE ATMOSPHERE BETWEEN 100 AND 227 KILOMETERS ABOVE WALLOPS ISLAND, VIRGINIA
Edith Meadows-Reed and Charles R. Smith Repr. from J. Geophys. Res., v. 69, no. 15, 1 Aug. 1964 p 3199–3207 refs
(NASA-RP-321)

The diffusive separation of argon and nitrogen was measured by means of a Bennett radio-frequency mass spectrometer carried on an Aerobee 150A rocket. The primary purpose of the spectrometer measurements was to obtain temperate latitude diffusive separation data to compare with those measurements obtained in the Arctic during the International Geophysical Year. The results indicate that diffusive separation occurred above about 110 km and that the altitude profile of the A/N_2 ratio is similar to that obtained during two night flights in the arctic atmosphere. Author

N64-32640* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEAN DIURNAL VARIATION OF THE TOPSIDE IONOSPHERE AT MID-LATTITUDES
S. J. Bauer and L. J. Blumle Repr. from J. Geophys. Res., v. 69, no. 17, 1 Sep. 1964 p 3613–3618 refs
(NASA-RP-344)

About 500 ionograms obtained with the Alouette satellite have been used to construct the mean diurnal variation of the midlatitude topside ionosphere. The data are presented in the form of electron-density contours at fixed altitudes for two latitude ranges, 35°–40° N and 40°–45° N. These ranges, which are approximately separated at the 75° W meridian by the 70° magnetic dip line, show remarkable differences in the detailed behavior of electron density as a function of time and altitude. From the scale heights of these mean distributions, it is apparent that there is absence of thermal equilibrium, at least during the day, and that light ionic constituents become important in the altitude region from 500 to 1000 km, especially during the night. There is also the suggestion of latitude gradients in the electron temperature and mean ionic mass. IAA

N64-32641* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INTERPRETATION OF A ROCKET MEASUREMENT OF ELECTRON DENSITY IN THE LOWER IONOSPHERE
A. C. Aikin, J. A. Kane, and J. Troim (Norweg. Defence Res. Estab.) Repr. from Space Research IV, Proc. of the 4th Intern. Space Sci. Symp., Warsaw, 3–12 Jun. 1963 p 358–362 refs

A midlatitude rocket measurement of electron density is presented for altitudes between 65 and 85 km. An interpretation of the profile indicates that the region between 70 and 85 km is ionized by the action of Lyman-alpha radiation on nitric oxide rather than by 2 to 8 A X-rays. Possible explanations are given for a minimum found in the electron-density distribution in the vicinity of the mesopause. Author

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-31371 ARO, Inc., Arnold Air Force Station, Tenn.
INTERPOLATIONS OF IMPERFECT AIR THERMODYNAMIC DATA. I: AT CONSTANT ENTROPY
C. A. Neel and Clark H. Lewis Arnold Eng. Develop. Center, Sep. 1964 292 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-183; AD-605471)

The recent thermodynamic air data of Hilsenrath and Klein and the previous low-temperature data of Humphrey and Neel have been interpolated at constant entropy over the ranges T = 100(100)15 000° K and S/R = 15.6(0.2)50, 50(1)133. Speed of sound data computed by Lewis and Neel are also included. Author

N64-31437 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics
HEAT TRANSFER OF PARTICLES IN THE DOMAIN WHERE NATURAL AND FORCED CONVECTION CO-EXIST
T. Tsubouchi and S. Sato *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 143–158 refs Presented at the 38th Gen. Meeting of the Japan Soc. of Mech. Engr., 5 Apr. 1961 and at the Intern. Heat Transfer Conf., Colorado U., Boulder, 1 Sep. 1961 (See N64-31429 23-11)
(Rept.-148)

When a small particle or a fine wire is heated in low speed airstream, the effect of natural convection on the heat loss is important. A typical example is the use of a thermistor or a hot-wire anemometer for measuring air velocities. In this case, the effect of the direction and the magnitude of airflow together with the natural convection effect must be taken into consideration. This study reports the results of measurement of heat-transfer coefficients by forced convection at very low air velocities (0.01 ~ 0.5 m/sec with varied flow directions; the specimens used were small bead-type thermistors. Author

N64-31439 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics
THE EFFECT OF PRANDTL NUMBER ON THE NATURAL CONVECTION HEAT TRANSFER OF SMALL PARTICLES

T. Tshubouchi, S. Sato, and H. Masuda *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 179–191 refs Presented at the 39th ann. meeting of the Japan Soc. of Mech. Engr., 3 Apr. 1962 (See N64-31429 23-11)
(Rept.-150)

In a previous paper, the experimental results of heat-transfer rates between single particles and air, due to natural convection, were reported. The specimens used were small bead-type thermistors. The correlation of $N_{u(L)}$ and $G_{r(L)}$ was extrapolated to that of $N_{u(L)}$ and $P_r G_{r(L)}$, simply following the similarity law. In this paper, the heat-transfer coefficient of small particles in still liquids of different Prandtl numbers was measured and it was ascertained that the extrapolated correlation in the previous report holds good in the wide range of $P_r (0.7 \sim 10^5)$ and could be written as

$$N_{u(L)} - N_{u,O(L)} = 0.45 (P_r G_{r(L)})^{1/4}$$

where L = 2 (volume) / (surface area) and $N_{u,O(L)}$ = the limiting Nusselt number. Author

N64-31444* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
LAMINAR FORCED CONVECTION IN RECTANGULAR CHANNELS WITH UNEQUAL HEAT ADDITION ON ADJACENT SIDES
Joseph M. Savino and Robert Siegel Repr. from Intern. J. Heat Mass Transfer, v. 7, 1964 p 733–741 refs
(NASA-RP-316)

Temperature distributions are determined analytically for fully developed laminar heat transfer in channels with aspect ratios from 1 to ∞ The channel walls are uniformly heated, but the heat flux on the short sides is an arbitrary fraction between 0 and 1 of the heat flux on the broad sides. For all cases, the wall temperatures are compared on the basis that the total heat transferred per unit channel length is maintained at a fixed value. The poor convection due to the low velocities in the corners and along the narrow walls always caused the peak temperatures to occur at the corners. For heating at only the broad walls, the corner temperature decreases rapidly as the aspect ratio is increased to about 10 and insignificantly thereafter. In the limit of infinite aspect ratio, the wall temperature distribution does not approach a constant as is the case for infinite parallel plates. Author

N64-31448* National Aeronautics and Space Administration, Washington, D.C.
THERMAL RESISTANCES IN CONTACT AREAS OF HEATING ELEMENTS [PROKONTAKTNI TERMICHNI OPORY U TEPLOVYDILYAYUCHYKH ELEMENTAKH]
V. S. Miller Mar. 1964 11 p refs Transl. into ENGLISH from Akad. Nauk Ukr. RSR, Inst. Teploenerg., Zb. Prats (Kiev), no. 24, 1962 p 133–139
(NASA-TT-F-8839) OTS: $1.00 fs; $0.50 mf

Some basic operating characteristics of heating elements are discussed. Experimental evidence is cited confirming the effect of various factors on thermal resistances between the core and shell of a heating element. The data were compiled to aid in designing efficient heating elements. D.E.W.

N64-31529 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RADIATIVE HEATING IN HYPERSONIC FLOW
L. M. Biberman, V. S. Vorob'yev, G. E. Norman, and I. T. Yakubov *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 130–156 refs (See N64-31522 23-29)

This article deals with the heating of a blunted body by the emission of a shock wave generated by that body in hypersonic flow. General expressions are presented for the calculation of the radiant flux. Particular attention is devoted to heating in the case of streamlining under conditions in which the gas behind the compression shock is virtually completely dissociated. An analysis has been carried out of the elementary radiation processes; the basic and decisive optical properties of the plasma formed behind the shock under these conditions are indicated. The methods employed to calculate the contribution of individual radiation processes to the emissive power of hot air are discussed. Emission in the continuous spectrum and over the entire range of spectral lines is considered. Values have been calculated to cover a wide range of temperatures, pressures, and layer thicknesses for spectral and integral radiant fluxes, incident on the streamlined body. Author

N64-31547* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
AN EXPERIMENTAL STUDY OF THE POOL HEATING OF LIQUID HYDROGEN IN THE SUBCRITICAL AND SUPERCRITICAL PRESSURE REGIMES OVER A RANGE OF ACCELERATIONS
Robert W. Graham, Robert C. Hendricks, and Robert C. Ehlers Washington, NASA, 1964 24 p refs Presented at Cryogenic Eng. Conf., Philadelphia, 17–21 Aug. 1964
(NASA-TM-X-52039) OTS: $1.00 fs; $0.50 mf

Pool heating of liquid hydrogen in the subcritical and supercritical pressure states has been investigated at earth gravity and at multigravities. Acceleration does influence the incipience of nucleate boiling but does not affect established nucleate boiling. The film boiling heat transfer is influenced by multigravity accelerations. A boiling-like mechanism was evident for hydrogen in the supercritical and near-critical state. Acceleration magnitude influenced the heat transfer in this fluid regime. Author

N64-31585 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI ABLATIVE SKIRT EXTENDED DURING TESTING
20 Mar. 1964 16 p
(Contract AF 04(695)-393)
(Rept.-0788-AST-1; AD-448602)

Two Titan II-configuration ablative skirts were tested for 198.7 and 220.4 sec, respectively. Both skirts performed satisfactorily throughout the extended duration simulated altitude test. The unit tested for 198.7 sec had partial liner failure after FS_2; the unit tested for 220.4 sec remained after shutdown. High volume nitrogen purges were initiated shortly before FS_2 in an effort to reduce the shock that occurs after shutdown. Nitrogen purges on previous altitude ablative skirt tests were initiated at FS_2. Author

N64-31667 Naval Ordnance Lab., White Oak, Md.
HEAT-TRANSFER MEASUREMENTS ON A FLAT PLATE IN THE NOL HYPERSONIC SHOCK TUNNEL NO. 1 Ballistics Research Report No. 47
D. F. Gates, B. J. Noonan, and L. Brekka 8 Oct. 1964 29 p refs
(NOLTR-61-91; AD-448592)

Heat-transfer measurements were made on a smooth, flat plate at Mach 8 and 10, with T_w/T_{aw} ratios from 0.09 to 0.150, and unit Reynolds numbers up to 38×10^6/foot. The results were compared to the laminar theories of Van Driest

and Cohen–Reshotko and to the turbulent predictions of Van Driest and Winkler–Cha. The laminar data showed good agreement with both theories, whereas the turbulent data were in agreement only with the Winkler–Cha prediction. Author

N64-31669 Naval Ordnance Lab., White Oak, Md.
COMPARISONS OF EXPERIMENTAL AND THEORETICAL HEAT TRANSFER TO A YAWED SPHERE-CONE MODEL AT SUPERSONIC SPEEDS Aerodynamics Research Report No. 207
Lionel Pasiuk 6 Dec. 1963 43 p refs
(NOLTR-63-208; AD-448887)

Theoretical laminar heat-transfer rates to a sphere-cone model at angles of yaw up to 18° are compared with wind-tunnel data measured at Mach 3.2 and 4.8. Two methods of heat-transfer prediction have been chosen—the methods of Beckwith and of Vaglio–Laurin. These require that the inviscid streamline pattern on the surface of the yawed sphere–cone model be known. These streamlines have been calculated from measured surface pressure distributions. The theory of Beckwith agrees reasonably well with the experimental data. Author

N64-31672 Naval Ordnance Lab., White Oak, Md.
AIR-FILM COOLING OF A SUPERSONIC NOZZLE Aerodynamic Research Report No. 244
Bing H. Lieu 18 Aug. 1964 41 p refs
(NOLTR-64-65; AD-448477)

An experimental study was made of the internal air-film cooling of a Mach 2.4, nonadiabatic wall, axially symmetric nozzle. The mainstream air was heated to supply temperatures from 672° to 1212° R at supply pressures from 115 to 465 psia. The film coolant air was injected through a single peripheral slot at an angle of 10° from the nozzle wall. The coolant-to-mainstream mass flow ratios were varied up to 20%. Steady-state nozzle wall temperatures were measured in both the subsonic and the supersonic flow regimes. The turbulent pipe flow equation of Dittus and Boelter was found to be applicable in predicting the heat-transfer rates in the absence of film cooling. A modified version of the semiempirical equation of Hatch and Papell was found applicable in estimating the film-cooled nozzle wall temperatures. Author

N64-31689 Naval Research Lab., Washington, D.C. Mechanics Div.
ANALYSIS OF THE AERODYNAMIC ABLATION OF A METAL SPHERE
P. K. Chang 13 Sep. 1963 26 p refs
(NRL-5953; AD-421893)

An approximate analytic solution has been developed for the ablated volume and shape of a metal sphere at hypersonic speeds in the early stages of aerodynamic ablation. The process of ablation, due to aerodynamic heating, is a very complicated phenomenon because of the possible existence of two layers—gas and liquid. If the metal surface is molten, then a liquid layer of molten metal is formed between the boundary layer of gas and the solid surface. The interdependent factors—flight time, flight conditions, and body shape—cause a variation of aerodynamic characteristics as a function of the trajectory. Furthermore, the aerodynamic ablation is responsible for a change in the shape of the body. Two cases of aerodynamic ablation were investigated. The first case considered the melting of body material alone, and the second considered melting with partial evaporation. Author

N64-31731* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
HEAT-TRANSFER DISTRIBUTION ON 70° SWEPT SLAB DELTA WINGS AT A MACH NUMBER OF 9.86 AND ANGLES OF ATTACK UP TO 90°
Philip E. Everhart and James C. Dunavant Washington, NASA, Oct. 1964 52 p refs
(NASA-TN-D-2302) OTS: $1.25

Heat-transfer distributions were obtained on 70° swept slab delta wings with sharp and blunt noses and cylindrical leading edges. The free-stream Reynolds number based on model thickness was 9×10^4. Lees' theory for the heat-transfer distribution is shown to be in good agreement with the data obtained on the nose and leading edge. The point of peak heating on the leading edge is in close agreement with the Newtonian stagnation point at all angles-of-attack. At angles-of-attack from 40° to 60° cross-flow theory was in excellent agreement with experimental center-line data; however, at other model attitudes the theory differed significantly from experiment. Nose blunting resulted in reduced heating rates over the aft center-line section of the wing at angles-of-attack less than about 40° Author

N64-31798 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATION OF HEAT FLUXES IN THE FLOW OF TWO DIFFERENT SUPERSONIC STREAMS AROUND A SHOULDER
R. K. Tagirov 27 Aug. 1964 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 6, 1963 p 55–61
(FTD-TT-64-364/1+2; AD-605798)

This is a calculation analysis of a method to find the base enthalpy in the flow of two different supersonic streams around a flat or ring-shaped shoulder. The surface of constant mass is used as control surface for the preparation of the heat-balance equation to find the specific heat flux. The experimental data of this study did not agree well with the computed data. G.G.

N64-31870 Joint Publications Research Service, Washington, D.C.
METHOD OF COMPLEX DETERMINATION OF THERMOPHYSICAL CHARACTERISTICS OF MATERIALS
R. A. Mustafayev *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 129–135 refs (See N64-31851 23-15) OTS: $5.00

In this article are expounded the basic methods permitting the determination of heat and temperature conductivity of the examined material that were obtained in the process of development of experimental data. The methods are based on the regularity of a cooling process in a solid body under the conditions of a steady thermal regime and are considered in relation to the bodies of the simplest form (plate, cylinder, and sphere). Author

N64-32044 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE CALCULATION OF INTERNAL HEAT EXCHANGE DURING POROUS COOLING
S. A. Druzhinin 9 Mar. 1964 16 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 9, Sep. 1961 p 73–77
(FTD-MT-63-210; AD-602559)

A methodology is offered for experimental investigation of internal heat exchange in porous metals with application of

heating by hf currents. Criterional dependences are obtained for porous samples of stainless steel with porosity of 30% and 50% during cooling by air. Author

N64-32161 Brookhaven National Lab., Upton, N.Y.
ORGANIC REACTOR COOLANT STUDIES
H. Susskind, J. Weiss, W. Becker, M. Beller, and C. H. Collins 30 Jun. 1963 182 p refs
(BNL-7650)

Described are the experimental equipment, procedures, and results of studying the mechanisms of fouling film formation in terphenyl coolants, the corrosion of metals by the coolant, and the pyrolytic and radiolytic stability of condensed ring polyaromatic compounds. R.L.K.

N64-32182 Technische Hochschule München (W. Germany)
TEMPERATURE COMPENSATION IN SIMPLE BODIES—A LEVEL PLANE, CYLINDER, SPHERE, SEMI-INFINITE BODY [TEMPERATURAUSGLEICH IN EINFACHEN KORPERN—EBENE PLATTE, ZYLINDER, KUGEL, HALBUNENDLICHER KORPER]
Ulrich Grigull Berlin, Springer-Verlag, 1964 23 p refs In GERMAN

Completely new data for the nonstationary one-dimensional heat flow of the level plane, cylinder, sphere, and semi-infinite body are found by computation with the application of the linear Fourier differential equations. Calculations were made for surface and center heat flow, as well as for the amount of heat used. G.G.

N64-32293 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
VARIATIONAL ANALYSIS OF ABLATION FOR VARIABLE PROPERTIES
M. A. Biot and H. C. Agrawal (Cornell U.) Apr. 1963 34 p refs
(CAL-SA-987-S-12)

The application of variational and Lagrangian thermodynamics is extended to problems of heat conduction with melting boundaries. The physical properties of the conducting material are considered to be temperature dependent. In particular, the material alumina (Al_2O_3), representing a class of ceramic materials for which the effective conductivity $k_{eff} = k_{phonon} + k_{photon}$, is subjected to above treatment, and the temperature distribution and the melting rate are found. The results are compared with the constant-conductivity case. Author

N64-32343 Lockheed Missiles and Space Co., Palo Alto, Calif. Research and Development Div.
HEAT SHIELD/STRUCTURE INTERFACE PROBLEMS PRODUCED BY ENVIRONMENTS ASSOCIATED WITH APOLLO LUNAR FLIGHT
May 1963 9 p
(LMSC-5-10-63-17)

The problem of successful joining or attachment of heat shield and structure is especially critical for the Command Module of the Apollo vehicle since is will encounter environmental extremes exceeding those experienced by either the Service Module or the Lunar Excursion Module. The initiation of a test program is proposed, which is aimed at the detailed examination of what is identified as the interface problem by utilizing a hydrogen–oxygen burner facility. By use of this facility, thermally induced stress problems may be examined in detail on scale-model sizes that are at least an order of magnitude larger than those that can be tested in high-energy air-arc facilities. The hydrogen–oxygen burner facility has a heating capability that overlaps the capability of quartz lamp banks as a lower bound and approaches the performance capability of some high-energy air-arc facilities at the upper bound. Author

N64-32390 United Aircraft Corp., East Hartford, Conn. Research Labs.
LAMINARIZATION OF NOZZLE WALL BOUNDARY LAYERS AS A MEANS OF REDUCING HEAT FLUX Status Report, 1 May–31 May 1964
R. L. O'Brien 12 Jun. 1964 12 p refs
(Contract AF 04(611)-9576)
(C-910100-9; AD-447063)

The heat exchanger is being fabricated by the inert gas-shielded arc welding technique. Fabrication of the modified heat exchanger assembly is currently 70% complete. Laminar heat transfer rates along test surfaces were calculated for a range of wall temperature ratios and unit Reynolds numbers by employing the modified Beckwith and Cohen method. Comparison of three calculation methods indicated that the modified Van Driest method, which was used to calculate the design cooling load distribution of the test surfaces, yields higher heat transfer rates. Additional theoretical calculations of turbulent heat transfer rates were also performed for a range of wall temperature ratios and Reynolds numbers. Author

N64-32433* Connecticut U., Storrs
HEAT TRANSFER STUDIES OF VAPOR CONDENSING AT HIGH VELOCITIES IN SMALL STRAIGHT TUBES
Winthrop E. Hilding and Charles H. Coogan, Jr. Washington, NASA, Oct. 1964 137 p refs
(Grant NsG-204-62)
(NASA-CR-124) OTS: $2.75

A set of simultaneous differential equations of change is derived for the concurrent, annular, two-phase, one-dimensional, steady flow of a pure condensing vapor and its liquid in a straight, cylindrical tube with heat transfer through the tube wall. Equations of momentum, continuity, and energy are combined with empirical relations for the physical properties of the liquid and vapor and with equations for interface velocity pressure and liquid layer thickness, thus reducing the system to a set of simultaneous, nonlinear, first-order differential equations involving only four derivatives. Starting with the known entrance flow conditions, the equations were solved numerically using variable incremental steps over the required condensing length. Flow properties for several cases were determined at each incremental point along the tube and were compared with experimental data for steam condensing in long, small diameter tubes. The data include local values of velocity, pressure, and total quality at each incremental step in the condensing process. Author

N64-32495 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
THERMAL RESISTANCE OF TURBINE-BLADE ROOT JOINTS
O. T. Il'Chenko and V. M. Kapinos 3 Sep. 1964 14 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 5, no. 6, 1959 p 23–26
(RSIC-261; AD-606047)

The paper discusses the theoretical determination of thermal resistance in forked, de Laval, and fir-tree root joints. The results of the calculation are compared with experimental data. Author

N64-32512 Naval Research Lab., Washington, D.C.
FIRE RESEARCH METHODOLOGY AT THE U.S. NAVAL RESEARCH LABORATORY AND SOME OF ITS "FALLOUT"
Richard L. Tuve [1964] 15 p refs Presented at the Spring Meeting, Western States Section, Combustion Inst., Stanford U., Calif., Apr. 1964
(WSS/CI Paper-64-2; AD-449235)

A continuous program of fire engineering research has been conducted for the past 25 years along lines of applied science. Engineering research results in areas involving the physical chemistry of foams, the free radical quenching action of certain Group I cations, and the useful surface chemistry of perfluorocarbons have resulted from this program. Author

N64-32537 Naval Ordnance Lab., White Oak, Md.
CHARTS OF EQUILIBRIUM REAL-GAS STAGNATION POINT CONDITIONS ON A SPHERE FOR ALTITUDES TO 200,000 FEET AND VELOCITIES TO 15,000 FEET PER SECOND Aerodynamics Research Report 222
P. D. Fisher Sep. 1964 30 p refs
(NOLTR-64-41; AD-448307)

This report presents in graphical form the stagnation-point pressure, temperature, equilibrium surface temperature, and heating rate for a sphere. Equilibrium real-gas effects and surface radiation are considered. The charts cover a range of velocities from 0 to 15 000 fps and altitudes from sea level to 200 000 ft. Corrections for sphere diameter and emissivity are included. Author

N64-32575 ARO, Inc., Arnold Air Force Station, Tenn.
INTERPOLATIONS OF IMPERFECT NITROGEN THERMODYNAMIC DATA. II: AT CONSTANT ENTROPY
C. A. Neel and Clark H. Lewis Arnold Eng. Develop. Center, Oct. 1964 235 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-213; AD-449381)

The recent nitrogen thermodynamic data of Hilsenrath and Klein, the data of Smith including only second virial corrections as presented by Lewis and Neel, and the previous low-temperature data of Little and Neel have been interpolated at constant pressure over the ranges T = 200(100) 15 000° K and log p = −7.4(0.1)4.2. Author

N64-32588 Columbia U., New York, N.Y.
ESTIMATE OF ERRORS IN APPROXIMATE TEMPERATURE AND THERMAL-STRESS CALCULATIONS Technical Reports Nos. 1, 26
Bruno A. Boley Jun. 1964 27 p refs
(Contracts Nonr-266(20); Nonr-4259(07))
(CU-1-64-ONR-4259(07)-CE; AD-601967) OTS: $2.00

After a general discussion of the estimate of errors in calculation of temperature and thermal stresses, a general theorem and a method for the construction of upper and lower bounds for the solution of three-dimensional heat-conduction problems is presented. Emphasis is placed on cases of moving boundaries, thus including problems of change of phase. Errors in stress calculations proper are then studied, with attention given to the fact that special difficulties are created by the existence of temperatures that cause zero stress. Elastic beams and plates are analyzed, and it is found that the maximum stress cannot exceed the quantity $4/3\alpha ET$ where T is the maximum difference in temperature in the body and the relevance of this fact in error estimates is noted. Author

N64-32633* General Electric Co., Cincinnati, Ohio Missile and Space Div.
ALKALI METALS BOILING AND CONDENSING INVESTIGATIONS Quarterly Progress Report No. 8, Apr. 1–Jun. 30, 1964
F. E. Tippets, ed. 20 Oct. 1964 415 p refs
(Contract NAS3-2528)
(NASA-CR-54138) OTS: $7.00 fs; $1.75 mf

Work on obtaining two-phase heat-transfer and fluid-flow data for potassium, under boiling and condensing conditions approximating those anticipated in large space turboelectric systems, is reported. Testing in the 300-kW facility with the 2-in. pitch helical insert and processing of the data obtained are progressing. The 100-kW facility test loop is being modified to increase the range of experimental values that can be tested, and previously unreported liquid and boiling data are presented. The 50-kW facility has been shut down for repairs and equipment installation. An analytical prediction of two-phase pressure drop for potassium is compared with test data from the 50-kW and 300-kW facilities. Overall heat losses for the pool-boiling apparatus have been determined in preparation for test operations. M.P.G.

N64-32680 Garrett Corp., Los Angeles, Calif. AiResearch Mfg. Div.
SNAP-50/SPUR BOILER COMPUTER PROGRAM
P. J. Berenson and A. M. Shah 3 Feb. 1964 37 p
(Contract AF 33(657)-10922)
(L-9390; AD-449614)

The computer program for analysis of SNAP-50/SPUR boiler was written for a shell and tube geometry in which the vaporizing potassium flows through tubes containing twisted-tape inserts. Either a counterflow or a parallel-flow configuration can be selected, and either lithium or sodium can be used as the shell-side heating fluid by specifying corresponding input instructions. The input includes the potassium flow rate, inlet temperature, inlet pressure, and reactor-fluid temperature. The program input, operating instructions, and equations are presented, as well as samples of source deck listing and printed and plotted output. D.S.G.

N64-32691* Minnesota U., Minneapolis Heat Transfer Lab.
THE THERMAL ANALYSIS OF ANODE AND CATHODE REGIMES IN AN ELECTRIC ARC COLUMN Quarterly Progress Report No. 5, 28 Jun.–1 Oct. 1964
E. Pfender, S. A. Wutzke, K. T. Shih, and E. R. G. Eckert 15 Oct. 1964 15 p
(Contract NAS3-2595)
(NASA-CR-54119) OTS: $1.00 fs; $0.50 mf

Investigation of heat-transfer phenomena occurring in electrical arcs included analysis of high-speed movies of the fluctuating arc mode and anode jet studies. A plane, segmented anode was designed and build, and a second plane anode was designed to fit in the bottom of the test section opposite and parallel to the upper anode, thus providing a two-dimensional anode geometry that should yield arc modes similar to those of a cylindrical anode and, at the same time, allow direct observation of the arc. M.P.G.

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-31440 Joint Publications Research Service, Washington, D.C.

THE TRAINING OF SOVIET COSMONAUTS

V.G. Denisov 7 Oct. 1964 145 p refs Transl. into ENGLISH of the book "Kosmonavt Letayet—Na Zemle" Moscow, 1964 p 1–151

(JPRS-26762; TT-64-51019) OTS: $4.00

A popular account is given of the methods and technical means that permit reconstructing on earth the unusual conditions of cosmic flight. Centrifuges, soundproof chambers, pressure chambers, rocket dollies, training apparatus, and a multitude of means of electronics and cybernetics are helping to prepare cosmonauts for future flights. Author

N64-31458 Joint Publications Research Service, Washington, D.C.

INDIVIDUAL DIFFERENCES AS FACTORS IN THE RESPONSES OF BRAIN POTENTIALS TO RHYTHMICAL LIGHT STIMULATION

V. D. Nebylitsyn *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 1–16 refs (See N64-31457 23-16) OTS: $4.00

The paper compares the following indicators: photic driving in a range from 5 to 22 cps; orienting and conditioned-reflex blockade of alpha rhythm during exposure to auditory and photic stimuli, or combinations thereof; and EEG components marked out with the help of a frequency analyzer. The results of the quantitative analysis of these correlations, expressed as coefficients, were computed by the moments method with the help of an electronic computer. A.W.

N64-31459 Joint Publications Research Service, Washington, D.C.

SOME PECULIARITIES OF MAN'S VOLUNTARY AND INVOLUNTARY EMOTIONAL REACTIONS

P. V. Simonov, M. N. Valuyeva, and P. M. Yershov *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 17–28 refs (See N64-31457 23-16) OTS: $4.00

An experimental study was conducted on 21 healthy persons of both sexes to determine manifestations of voluntarily evoked and involuntarily aroused defensive reflexes conditioned by anticipation of strong painful stimulation. It is concluded that sense impressions, mentally reproduced by a person anticipating an impending painful stimulus, cause intense shifts in heart rhythm, galvanic skin response, and EEG frequency spectrum even when no such stimulus follows. A.W.

N64-31460 Joint Publications Research Service, Washington, D.C.

CHANGES IN THE RELATIONSHIPS OF THE ORIENTING AND MOTOR CONDITIONED REFLEXES UNDER THE INFLUENCE OF ATROPINE

E. A. Kostandov *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 29–47 refs (See N64-31457 23-16) OTS: $4.00

The influence of atropine was studied on 36 schizophrenia patients with apathy-abulia syndrome. Psychic deficiency, pronounced to some degree, was found in the patients during clinical examination. The majority of patients had had the disease for over five years. Delusions of reference and persecution were noted in some cases, but they were unsystematized and fragmentary, were incidentally expressed by the patients, and did not determine their behavior. All the patients were languid, apathetic, and inactive; as a rule, they did not enter into conversation themselves, and answered questions in monosyllables. They associated but little with those around them. Often observed were argumentation and paralogia, and sometimes incoherence of thought. Usually the patients manifested no uneasiness over their legal situation or their future fate. Emotional depression or dullness was clinically noted in all the patients. Author

N64-31461 Joint Publications Research Service, Washington, D.C.

THE PHYSIOLOGICAL SIGNIFICANCE OF SOUNDS OF THE HUMAN VOICE

P. S. Shpakov *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 48–63 refs (See N64-31457 23-16) OTS: $4.00

Observations were conducted on children of ages 3 to 15. Their responses to a simultaneous complex stimulus consisting of both physical agents (lights, buzzers, etc.) and sounds of the human voice were noted. In general, reactions to the sound of the human voice were extinguished later than reactions to the physical components. The sound of the human voice, because it has some qualitative parameters different from those of the lights and buzzers used, introduces new interrelations in physiological functions. A.W.

N64-31474 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

WHO MAY BECOME AN ASTRONAUT

M. A. Novikov 23 Jul. 1964 11 p refs Transl. into ENGLISH from Zdorov'ye (USSR), no. 4, 1963 p 4–7

(FTD-TT-64-260/1; AD-605236)

The necessity for the astronaut to withstand the factors of space flight has led to a variety of psychological tests. The importance of group as well as individual selection is mentioned, and some of the features of group solidarity are discussed. R.L.K.

N64-31508 Office of Naval Research, Washington, D.C. Engineering Psychology Branch

VISUAL, DISPLAY, AND CONTROL PROBLEMS RELATED TO FLIGHT AT LOW ALTITUDE

James W. Miller, ed. [1964] 57 p refs Proc. of a Symp., jointly sponsored by Autonetics, held in Anaheim, Calif., 3–5 Mar. 1964

(ACR-95; AD-602823) OTS: $3.00

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1. GENERAL COMMENTS p 1–12

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3. OPERATIONAL PROBLEMS IN LOW-ALTITUDE HIGH-SPEED MISSIONS L. C. Baldwin and D. C. Owings p 26 (See N64-31510 23-22)

4. VISUAL ASPECTS OF LOW-LEVEL FLIGHT H. L. Snyder (Autonetics) p 27–37 refs (See N64-31511 23-14)

5. HUMAN PERFORMANCE DURING VIBRATION C. S. Harris and R. W. Shoenberger p 38–47 refs (See N64-31512 23-14)

N64-31509 Human Factors Research, Inc., Los Angeles, Calif.

GEOGRAPHIC ORIENTATION DURING LOW-ALTITUDE FLIGHT

James J. Mc Grath *In* ONR Visual, Display, and Control Problems Related to Flight at Low Altitude [1964] p 13–25 ref (See N64-31508 23-14) OTS: $3.00
(Contract Nonr-4218(00))

An analysis is presented showing that geographic disorientation (as differentiated from spatial disorientation) occurs frequently enough in present-day aviation operations to significantly affect the success of those operations. A statistical description of actual incidences of geographic disorientation was undertaken to delineate the areas of human performance research needed to reduce the incidence of such disorientation. A systematic research plan is outlined that includes motion-picture methods to study visual-cue fidelity, terrain-model methods to study pilot mobility, and verification by actual field studies. M.P.G.

N64-31511 Autonetics, Anaheim, Calif.
VISUAL ASPECTS OF LOW-LEVEL FLIGHT
Harry L. Snyder *In* ONR Visual, Display, and Control Problems Related to Flight at Low Altitude [1964] p 27–37 refs (See N64-31508 23-14) OTS: $3.00

Those parameters of low-altitude flight that have the most influence on visual performance are identified, and the extent to which each parameter affects dynamic visual performance is indicated. The parameters are separated into two classes: (1) physical and geometric factors; and (2) human visual limitations. The physical and geometric factors considered are these: masking; size and shape of targets; illuminance, luminance, and contrast; number of objects in the visual field; and ground speed and time available for search. The human visual limitations are considered in relation to the effects of object luminance and contrast, angular velocity and blur, and static vs dynamic acuity. Some possible approaches to research in low-level visual problems are discussed. M.P.G.

N64-31512 Air Force Systems Command, Wright-Patterson AFB, Ohio Behavior Science Lab.
HUMAN PERFORMANCE DURING VIBRATION
Charles S. Harris and Richard W. Shoenberger *In* ONR Visual, Display, and Control Problems Related to Flight at Low Altitude [1964] p 38–47 refs (See N64-31508 23-14) OTS: $3.00

The problems associated with determining the effects of buffeting and vibration on human performance in low-level high-speed flight missions are discussed; experimental data are reviewed; and some guidelines for vehicle designers and human factors researchers are presented. The general agreement between frequency–maximum acceleration curves of tolerance to vibration for short times (1 hour or less) and long time exposures is demonstrated graphically. These data are discussed in relation to both visual acuity experiments and tracking performance. Systematic behavioral studies are needed in the low-g range within the frequencies from 1 to 20 cps in order to study performance changes and to specify, for a given frequency, at what intensity level significant decrement begins to occur. The need for a test to identify vibration-sensitive individuals is also indicated. M.P.G.

N64-31665 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
DISPLACEMENT AND DURATIONAL CHARACTERISTICS OF LEVER PRESSING IN FIXED RATIO AND IN EXTINCTION
Robert M. Herrick 7 Jul. 1964 34 p refs *Its* Rept. No. 13 (NADC-ML-6407; AD-447394)

Considering lever presses of different displacements as different responses, some characteristics of FR5 behavior found were these: (1) variability comparable to that of extinction; (2) no "least effort" tendency; (3) no tendency to repeat reinforced responses; (4) a slight tendency to repeat nonreinforced responses; (5) a decrease in mean displacement as a function of the ordinal number of the press following reinforcement. There were no significant correlations between displacement distributions in acquisition and extinction. In extinction Ss tended to repeat successive responses. Median response durations and median interresponse times in extinction remained about the same as in acquisition, but extreme values occurred more frequently than in acquisition. Author

N64-31666 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
SIMULATION AND EFFECTS OF SEVERE TURBULENCE ON JET AIRLINE PILOTS
Stuart Ragland, Jr., Randall M. Chambers, Richard J. Crosbie, and Lloyd Hitchcock, Jr. 13 Aug. 1964 53 p refs
(NADC-ML-6411; AD-448067)

The acceleration profile in the G_z axis of UAL 720-B, Flight 746, N7213U, which had encountered severe turbulence in the cirrus portion of a thunderstorm, was programed on the centrifuge. The aircraft had dived from 37 500 feet to 12 000 feet before being brought under control. The simulated turbulence produced accelerations that fluctuated from a maximum of $+3.5\ G_z$ to a maximum of $-2\ G_z$ at a random frequency average of 1 cps. The pilot and copilot who had flown the actual flight were the first to experience the centrifuge simulation. They pronounced it excellent. Effects upon pilot performance detrimental to safe control of the aircraft are thought to have been observed and recorded. On the basis of this limited pilot study, it appears that there is a consistent tendency to experience a kinesthetic illusion that causes the pilot to make inappropriate pitch control movements. Author

N64-31695 Ohio State U., Columbus Lab. of Aviation Psychology
RESEARCH ON DISPLAY VARIABLES Final Report
William C. Howell and Jerry D. Tate Griffiss AFB, N.Y., RADC Aug. 1964 48 p refs
(Contract AF 30(602)-3066)
(RADC-TDR-64-266; AD-606637)

Three formal experiments were conducted on variables contributing to the accessibility, for human viewers, of information in large-scale displays. Major variables of interest were these: (1) duration of inspection; (2) amount of relevant and irrelevant information; (3) degree of irrelevancy; (4) kind of irrelevancy; (5) display format; and (6) excellence of event patterning. All results pointed toward two major conclusions: (1) The subject increases accessibility through organization, at a peripheral level, of relevant information. (2) Storage of display information involves two distinct processes—one more central and permanent, the other more peripheral and temporary. Implications for display design are discussed. Author

N64-31827 Lockheed-Georgia Co., Marietta Aerospace Medical Div. Aerospace Medical
COMBINED EFFECTS OF SLEEP LOSS AND DEMANDING WORK-REST SCHEDULES ON CREW PERFORMANCE

Earl A. Allisi, W. Dean Chiles (Aerospace Med. Div.), and Thomas J. Hall Wright-Patterson AFB, Ohio, AMRL, Jun. 1964 72 p refs
(Contract AF 33(657)-10506)
(AMRL-TDR-64-63; AD-606214)

Four 12-day confinement studies are reported. In each of two of these studies, subjects were organized into two 5-man crews who worked alternating shifts on a schedule of 4 hours on duty and 4 hours off for the entire 12-day confinement period. In each of the other two studies, six USAF pilots were confined for 12 days while following a schedule of 4 hours on duty and 2 hours off. During the middle two days of the 12-day confinement period, i.e., on days six and seven, the crews following the 4–4 work–rest schedule were assigned extra work that resulted in each man's remaining awake for a 44-hour period; on the same days, the crews following the 4–2 schedule were assigned extra work that resulted in each man's remaining awake for a 40-hour period. The data show that performance is generally inferior on the 4–2 schedule as compared to the 4–4 schedule and that the stress of a period of sleep loss results in generally greater performance decrements on the 4–2 than on the 4–4 schedule. Author

N64-31944 Republic Aviation Corp., Farmingdale, N.Y.
SPECIFICATION OF OPTIMUM FAULT ISOLATION PRESENTATION Technical Documentary Report, Mar. 1963–Mar. 1964
W. R. Atchley, J. Ver Hulst, and D. J. Lehr Wright-Patterson AFB, Ohio, AMRL, Jun. 1964 87 p refs
(Contract AF 33(657)-10834)
(AMRL-TDR-64-57; AD-606215)

This report describes the development of a System Analysis Model (SAM), utilizing equipment characteristics and maintenance environments of Air Force equipments, which provides a guide for technical writers in the selection of the most efficient fault isolation presentations for current and R&D systems. From this model, three characteristics that affect the efficiency of fault isolation presentation formats were selected for experimental manipulation and evaluation. These characteristics (type of circuitry, type of indicators, and system complexity) were used to evaluate the relative efficiency, in terms of performance accuracy and time, of three fault isolation presentation formats—standard schematics, data flow diagrams, and proceduralized instructions. Their nonsignificant differences suggest that the criterion for choosing between standard schematics and data flow diagrams would be the cost of development when dealing with equipments with similar characteristics. Proceduralized instructions were found to be more efficient than the other two formats. Author

N64-32037 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
RESPONSE AND FEEDBACK TECHNIQUES FOR AUTOMATED TRAINING OF VISUAL IDENTIFICATION SKILLS
Alexander Z. Weisz and Linda S. Mc Elroy Jul. 1964 32 p refs
(Contract N61339-789)
(NAVTRADEVCEN-789-3; AD-447882)

A small-scale study investigated the extent to which results in favor of covert response techniques over confirmation procedures, found for paired-associate materials and identification of nonverbal sounds, apply to visual identification tasks. Three overt response procedures differing in the time at the number of tries permitted, were compared with two prompting procedures requiring no overt response. The learning task involved discriminating among three values for each of four dimensions of variation of unfamiliar forms. Differences in performance between prompting and confirmation groups were not significant. The best procedure was one in which immediate feedback, cueing, and a simplified display of feedback information were combined. Author

N64-32066 Federal Aviation Agency, Oklahoma City, Okla. Aeromedical Research Div.
STUDIES ON AIR LOADS ON MAN
John J. Swearingen and Ernest B. Mc Fadden [1954] 9 p refs
(AD-602207) OTS: $1.00

Data obtained in three different studies related to measurement of forces on the body due to air movement are summarized. The effects of short-duration blast forces on personnel seated or standing at various distances from openings during pressure loss, blast forces necessary to disorient the body from numerous positions, effect of clothing on the drag forces, and measurements of forces and moments on the body during wind-tunnel tests are discussed and compared. Author

N64-32154 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio
AN EXPERIMENTAL INVESTIGATION UNDER ZERO-GRAVITY CONDITIONS OF TETHERED WORKER MAINTENANCE TECHNIQUES
Fred Henry Ernst and Roy Benjamin Smith (M.S. Thesis) Aug. 1963 104 p refs
(GA-63; AD-419776)

Three major tasks are involved: (1) devising and fabricating tethering devices and test apparatus; (2) testing the tethering devices under conditions that simulated, as closely as possible, the conditions the maintenance man will encounter in space; and (3) analyzing all test results to assure that any proposed tethering device did, in fact, provide the required capability. Of the 10 tethering devices tested, the device meeting all criteria was one that consisted of direct attachment through eyebolts and clamps between the worker's toes and the work area, and attachment through adjustable length straps between the worker's waist and the work area. The applicability of the other tethering devices was also determined. Author

N64-32208 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE EFFECTS OF VIBRATION ON DIAL READING PERFORMANCE Technical Documentary Report, May 1963–Feb. 1964
Harvey A. Taub Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Jul. 1964 27 p refs
(Contract AF 33(657)-11729)
(VH-1838-E-1; AMRL-TDR-64-70; AD-603963)

Four experiments were performed to determine the effects of whole-body sinusoidal vibrations in the X-, Y-, and Z-axes upon dial-reading performance. The subjects were in the semi-supine position so that the force of gravity was directed through the X-axis of the body. In all four experiments, performance of 6, 11, and 15 cps was compared at various levels of acceleration with and without the use of a helmet restraint. Further, performance was assessed with an easy and a difficult dial reading task. The results indicated that performance with the easy task was relatively unaffected by the vibration conditions, whereas large and significant losses in performance occurred with the difficult task. Mean errors for the difficult dial reading task increased significantly as the acceleration level of vibration increased. The results further indicated that the effects

of helmet restraint and frequency upon performance with the difficult reading task varied with the direction of vibration. Author

N64-32375 Naval School of Aviation Medicine, Pensacola, Fla.
CUMULATIVE EFFECTS OF REPEATED EXPOSURE TO HIGH-INTENSITY TONES UPON RECOVERY OF AUDITORY SENSITIVITY
Vernon C. Bragg 4 Aug. 1963 14 p refs
(AD-420856)

An investigation was designed to study the progress of measurable accumulation in the time required to recover auditory sensitivity as such accumulation develops following successive exposure to tonal stimulation at various intensities. The results were considered as they relate to the physiology of hearing and the possibility of testing for noise susceptibility. Two major conclusions emerged from the findings of this study: First, the pattern of recovery time curves appears to confirm the concept of a critical intensity. Specifically, under the conditions of the study, it appears that a different mechanism of cumulation is responsible for the responses to exposures in excess of 95 dB than for those below this critical level. It is concluded that 95 dB represents a critical intensity below which adaptation is evoked and above which cumulative fatigue is effected. Second, it was concluded that only those responses which resulting from exposures in excess of the critical intensity showed promise for use in a test of noise susceptibility. Author

N64-32529 Iowa State U. of Science and Technology, Ames Agricultural and Home Economics Experiment Station
FAMILY ADOPTION OF PUBLIC FALLOUT SHELTERS. A STUDY OF DES MOINES, IOWA Final Report
Gerald E. Klonglan, George M. Beal, and Joe M. Bohlen 1964 192 p refs Its Rural Sociol. Rept. No. 30
(Contract OCD-OS-62-150)
(AD-603125) OTS: $6.00

An analytical frame of reference was developed that can be used for planning, implementing, and evaluating civil-defense programs, involving the adoption of novel ideas or programs by individuals in target audiences. The extent to which a sample of people had adopted the idea of using public fallout shelters, in case of nuclear attack, was determined for the specific group selected. Relationships were determined and are stated between selected demographic, knowledge, attitude, and information variables and the adoption of the innovation of using the fallout shelters. D.E.W.

N64-32606 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A BIBLIOGRAPHY OF RESEARCH ON HUMAN TRACKING PERFORMANCE
Richard A. Monty, Joyce E. Obermaier, and William J. Ruby Sep. 1963 42 p refs
(CAL-131; AD-420186)

N64-32681 George Washington U., Washington, D.C. Human Resources Research Office
THE DEVELOPMENT OF TRAINING OBJECTIVES
Robert G. Smith, Jr. Jun. 1964 108 p refs
(Contract DA-44-188-ARO-2)
(HUMRRO-RB-11; AD-448364)

This bulletin describes modern concepts and techniques used in determining training objectives. A training objective is a precise clear statement of one of the performances expected of a student upon completion of a course, and a complete list of such objectives constitutes the mission of a course. The concepts and techniques described are based on research performed by both military and civilian researchers in the field of training. Author

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-31428 Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
AREA PROPERTIES OF TELEVISION PICTURES Physical Sciences Research Paper No. 23
S. Nishikawa, R. J. Massa, and J. C. Mott-Smith Jun. 1964 20 p refs
(AFCRL-64-478; AD-605275)

Area size distributions are measured for four different still pictures formed of 510 × 512 elements linearly quantized to 8 amplitude levels (3 bits). The initial results of this continuing measurement program indicate the following for the measured pictures: (1) First-order brightness distributions tend to be uniform. (2) The largest number of areas occur for the intermediate grey levels, with considerably fewer areas encountered at either black or white. (3) The average size of black or white areas is larger than for the intermediate greys. (4) Black and white areas appear to be more simply connected than intermediate grey areas. (5) The frequency of occurrence of areas of size n-elements falls off with n a little slower than $1/n^2$ (6) The area size distributions for each picture appear quite similar; the greatest differences between them are in the area size range 20 to 200 elements, and in the presence or absence of one or two very large areas. Author

N64-31481 Ford Instrument Co., Long Island City, N.Y.
SYNCHRONOUS ROTATING PENDULUM ACCELEROMETER
H. Blazek and A. Zechnowitz *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 36–49 refs (See N64-31476 23-17) OTS: $9.40

This paper describes a novel inertial digital accelerometer. The approach involves a digital technique for detecting the rotational modulation of an unbalanced cylinder caused by an input acceleration. The cylinder is made to rotate at a constant average speed. Basic theory is presented, and sources of error discussed. A feasibility model is described, and test data on a similar device are presented. Author

N64-31483 Fairchild Controls Corp., Hicksville, N.Y.
PRECISION POTENTIOMETERS, LOW NOISE—LONG LIFE
Robert W. Quinn *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 57-63 (See N64-31476 23-17) OTS: $9.40

Materials and characteristics found to be necessary to improve reliability in potentiometers are discussed. The characteristics discussed involve the following parameters: wire alloys; contact material—diameter matching and pressure, collector material and finish, lubrication, and run-in or burn-in. P.V.E.

N64-31485 Wright Machinery Co., Durham, N.C.
SOME ASPECTS OF THE DESIGN AND TESTING OF PRECISION A-C DRAG CUP TACHOMETERS
P. H. Trickey and B. L. Fuller *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 93–135 refs (See N64-31476 23-17) OTS: $9.40

Discussed are the basic equations and the effect of changing the various parameters on the output, phase shift, and linearity of the tachometer, as well as the effect of some of these parameters on the temperature compensation network design. Also discussed are the problems involved in testing the tachometer for its parameters, in the performance testing of the tachometer, and in manufacture and production test. Author

N64-31490 Minnesota Mining and Mfg. Co., St. Paul, Minn. Instrument Dept.
BRUSHLESS ANALOG TO DIGITAL SHAFT POSITION ENCODER FOR EXTENDED ENVIRONMENTAL OPERATIONAL REQUIREMENTS
Amey Landy, Jr. *In* Bur. of Naval Weapons Proc. of The Rotating and Static Precision Components Symp. Apr. 1964 p 212–222 (See N64-31476 23-17) OTS: $9.40

A 13-bit multiturn brushless shaft encoder is described. The encoder employs optical techniques, including incandescent lamps, two opaque and translucent code pattern wheels, silicon p-n photocells, and silicon controlled rectifiers for delivering high-current outputs. The gear train ratio between the two code wheels (fast and slow) is 64:1. One turn of the input shaft creates 1/64 of a turn on the second or slow wheel. A nonambiguous binary code pattern is used on the code wheel patterns and for the output numbering system. The encoder was developed in order to obtain triggering of silicon-controlled rectifiers directly from silicon p-n photocell reading stations. The optical assembly and electronic assembly are discussed in some detail. Also discussed is planned development of a microelectronic version. P.V.E.

N64-31491 Baldwin (D.H.) Co., Cincinnati, Ohio
A PROTOTYPE MODEL 13-DIGIT SEQUENTIAL SIZE 11 OPTICAL ENCODER
John W. Brean *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 223–241 refs (See N64-31476 23-17) OTS: $9.40

An encoder is described that was developed to satisfy the demand for a high-resolution transducer in a small package that could be operated with a minimum of auxiliary equipment. The encoder, including electronics, is housed in a single package similar to a size-11 synchro. The unit has a resolution of 8192 divisions (13 binary digits) for one revolution, and operates in the sequential mode at rates up to 1 million digits per second. The transducer utilizes optical techniques to translate the position of a measured shaft into pulse-coded signals that represent the angular position of the shaft and to transmit them to external equipment. P.V.E.

N64-31492 Naval Air Development Center, Johnsville, Pa. Aeronautical Instruments Lab.
PROBLEMS AND TECHNIQUES ENCOUNTERED IN ENCODER EVALUATION
Frank J. Alessandro *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 242–254 (See N64-31476 23-17) OTS: $9.40

The use of two types of equipment (oscilloscopes and oscillographs in combination with logic circuits, and recording oscillographs) for evaluating an encoder is discussed. Also discussed is an automatic checker for encoders that will be able to independently control interrogation voltages, brush currents or sensor input impedances, and discriminating levels and bandwidths. P.V.E.

N64-31499 Naval Ordnance Lab., Corona, Calif.
DETECTION AND MEASUREMENT OF SMALL MAGNETIC FIELDS
A. R. Clawson and H. H. Wieder *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 362–376 refs (See N64-31476 23-17) OTS: $9.40

A magnetometer based upon the Hall effect was designed and built for the purpose of measuring the vector magnitude of magnetic fields in the range of $1\ \text{Oe} \geq H \geq 10^{-5}$ Oe. The principal design features of the Hall generator sensor, the flux multiplier, and the signal amplifier–indicator are presented in detail. The physical properties of the semiconductor films of indium antimonide vacuum deposited upon glass substrates are described, and their use in the fabrication of sensitive Hall generators is illustrated. The requirements imposed upon the Hall voltage amplifier are discussed in connection with problems encountered in the measurement of small fields against the background of the earth's magnetic field. Author

N64-31502 Bureau of Naval Weapons, Washington, D.C. Engineering Div.
ANALOG TO DIGITAL, BRUSHLESS, SHAFT ENCODER DEVELOPMENT PROGRAM
Richard A. Retta *In its* Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 444–448 (See N64-31476 23-17) OTS: $9.40

The disadvantages of brush-type encoders are outlined. The development of brushless encoders of the following three types is briefly discussed: magnetic—saturable core or variable reluctance type, capacitive type, and optical type. P.V.E.

N64-31506 Bureau of Naval Weapons, Washington, D.C.
INVESTIGATION OF POTENTIOMETERS FOR NEW SPECIFICATION REQUIREMENTS
James W. Case *In its* Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 475–483 refs (See N64-31476 23-17) OTS: $9.40

A promising solution has been found to the electrical noise and life problem with potentiometers in the Mk 118 and Mk 119 computers. Essentially this is to recognize a relatively narrow temperature range of the environment of the computers aboard ships, thereby permitting the use of noble metal potentiometer wire with long-life, low-noise properties. No serious effect on system performance can be expected from the use of noble metal wire, even if new pots made from it are used as direct replacements of base metal wire pots. Potentiometers from nickel–iron wire will continue to be used where low noise performance is not a requirement. Author

N64-31548* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRECISION OPTICAL TRACKING SYSTEM FOR ADVANCED LAUNCH VEHICLES

Charles L. Wyman, Klaus Juergensen, Robert L. Kurtz, Larry Hayes, and John M. Gould 25 Jun. 1964 85 p refs
(NASA-TM-X-53076) OTS: $3.00 fs; $0.50 mf

The development efforts on an experimental optical radar system for precision tracking for advanced launch vehicles during the early launch phase are described. Basic concepts for a prototype system are discussed along with some advanced techniques that are being investigated. Analyses and investigations concerning the project are discussed. An error analysis is made assuming a tracker that measures elevation angle, azimuth angle, and distance in digital form. The analysis is concerned with errors in distance, velocity, and acceleration computed from distance measurements. A trajectory analysis is performed utilizing a typical Saturn V trajectory to determine the dynamic range of the instrument parameters. Vehicle and instrument parameters are plotted against time, and the curves are used for design purposes. A range analysis develops optical radar equations. The system uses retrodirective corner reflectors on the booster to increase the return signal. Author

N64-31567* National Aeronautics and Space Administration, Washington, D.C.
DEVICE FOR MEASURING THE TORSION OF ROTATING BODIES PATENTED 13 DECEMBER 1910 [VORRICHTUNG ZUR MESSUNG DER TORSION ROTIERENDER KORPER]
Johannes Görges and Paul Weidig Sep. 1964 6 p Transl. into ENGLISH from Imperial German Patent No. 242913, 26 Jan. 1912
(NASA-TT-F-9128) OTS: $1.00 fs; $0.50 mf

The invention concerns a device for measuring the torsion of rotating bodies, e.g., an axle with one end that moves while the other is stationary or performs another task. Mirrors are attached to the cross sections of the rotating body, whose torsions are to be compared, in such a way that they participate in the movement of the cross section. A light ray is directed so that it is reflected successively by both mirrors, thus enabling provision for deriving the magnitude of the torsion existing between the two cross sections from the light-ray deflection. Author

N64-31588 General Electric Co., Schenectady, N.Y. Light Military Electronics Dept.
FEASIBILITY DEMONSTRATION OF DIGITAL DISPLACEMENT SENSING TECHNIQUES Technical Documentary Report, Nov. 1962–Apr. 1963
F. A. Ludewig, Jr. et al Wright-Patterson AFB, ASD, May 1964 63 p
(Contract AF 33(657)-8284)
(ASD-TDR-63-475; AD-601225)

Theoretical and experimental data are presented that establish feasibility of designing an 11-bit digital displacement transducer, using the optical ruling technique. Experimental data were obtained on an 11-bit displacement transducer with parallel Gray coded output. The full-scale travel was 0.1024 inches, and the resolution was 50 microinches. Design concepts incorporated in the experimental transducer are feasible for production units. Author

N64-31596 Weston Instruments, Inc., Newark, N.J.
PRODUCTION ENGINEERING MEASURE FOR RUGGEDIZED TAUT-BAND-SUSPENSION PANEL METERS PER SIGNAL CORPS TECHNICAL REQUIREMENTS SCS-43A, 15 NOVEMBER 1960 Final Report, 1 Apr. 1961–30 Jun. 1964
[1964] 34 p refs
(Contract DA-36-039-SC-85952)
(AD-491325)

The ruggedized taut-band-suspension panel meter has sensitivity values higher than can be obtained with pivot and jewel-type ruggedized instruments. It has complete freedom from internal friction and dimensional interchangeability with Weston ruggedized instruments containing pivots and jewels. Balance change resulting from the ruggedization tests of vibration, random drop, and high shock is the most significant factor in limiting accuracy after test. R.L.K.

N64-31627 Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
SNAPTRAN 2/10A-3 PHOTOGRAPHY
30 Jul. 1964 39 p ref Sponsored by AEC
(EGG-1183-1071; L-676) OTS: $1.00

Described is the photographic and optical instrumentation designed for use in the SNAPTRAN test—a destruct test to determine the most violent accident that could result if a missile aborted and a SNAP reactor fell into the sea. The camera installations were located outside the tank containing the reactor and viewed the reactor through water-filled periscopes. Radiation protection for the cameras was provided by large lead coffins with lead drop doors that closed immediately after the pictures were obtained. Two types of cameras were used—high-speed KFC-600 cameras took 12 frames programed over 175 microseconds, and Dynafax framing cameras were operated at 17 680 and 8600 frames per second. Underwater backlighting was used to silhouette the reactor in the camera fields of view. The EG&G xenon flashtubes provided the lighting for KFC-600 cameras, and conventional flashlamps provided the lighting for the Dynafax cameras. The two camera systems were triggered independently. R.L.K.

N64-31659 Frankford Arsenal, Philadelphia, Pa. Research and Development Directorate
SOME RECENT DEVELOPMENTS IN DYNAMIC PHOTOELASTICITY
P. D. Flynn, J. T. Gilbert, and A. A. Roll May 1964 7 p refs
(A-64-14; AD-448885)

A dual-beam polariscope for obtaining simultaneous normal- and oblique-incidence photoelastic stress patterns was recently designed for use with a high-speed framing camera. Dynamic stress patterns were photographed at speeds up to 720 000 frames per second using flashtubes and filters to obtain monochromatic light. The equipment and techniques are described, and preliminary results are given. Author

N64-31677 Pennsylvania State U., University Park Dept. of Physics
RESEARCH IN THE FIELD OF HIGH RESOLUTION INFRARED SPECTROSCOPY Final Report
T. K. Mc Cubbin, Jr. 15 Mar. 1964 141 p refs
(Contract AF 19(604)-5458)
(AFCRL-64-324; AD-602493)

Spectroscopic apparatus capable of measuring laboratory absorption spectra at medium infrared wavelengths with a resolution of 0.08 cm^{-1} and a precision of 0.005 cm^{-1} has been developed. A new double pass system and two prism echelle spectrometers, one a vacuum instrument, are described. A computation and quantitative measurement of the radiant power transmitted by the spectrometer has been made. These instruments have been used to investigate the Fermi resonance, $(l|l \pm 2)$ resonance, and other phenomena in several isotopic nitrous oxides by a study of the spectra in the 8μ and 17μ regions. Author

N64-31706 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
QUALITY CATEGORIZATION OF AERIAL RECONNAISSANCE PHOTOGRAPHY Final Report
Paul G. Roetling, Harry B. Hammill, and Thomas M. Holladay 30 Sep. 1963 129 p refs
(Contract AF 30(602)-2684)
(CAL-VE-1667-G-1; RADC-TDR-63-279; AD-420923)

The derivation of a summary measure, which would relate measurable photographic parameters to the information content that a photo interpreter could extract from the photograph, was investigated. Four parameters of quality were chosen that describe image contrast, grain, and modulation curve (resolution and passband). Image modification methods and measuring techniques, which could be used without recourse to test charts, were developed for black and white photographs. A thousand photographs with a range of quality parameters were generated and used in interpretation tests. Standard statistical methods were employed in an attempt to obtain the correlation between the photo interpreter scores and the measured variables of the photographs. Author

N64-31728* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL OHMMETER
John Semyan Washington, NASA, Oct. 1964 17 p
(NASA-TN-D-2003) OTS: $0.50

This paper describes a unique method of digitizing resistive sensor outputs for telemetry. In the system proposed, the resistance to be measured comprises the unknown leg of a wheatstone bridge, which is automatically nulled by sequentially adding the required binary values of resistance in series in the known leg. The states of the reed relay switches that control the binary balancing resistance then constitute a parallel digital word, which represents unknown resistance. An absolute accuracy of ±0.05% is easily achieved. A design example that was used to prove the practicality and accuracy of the system is presented in detail. Some consideration is given to possible improvements in power consumption, range of resistance measurement, and operating speed. Author

N64-31729* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF FOLD-OVER ERRORS IN FLUX-GATE MAGNETOMETERS
John Dimeff, Murray S. Gardner, and Richard S. Murphy Washington, NASA, Oct. 1964 13 p refs
(NASA-TN-D-2159) OTS: $0.50

Externally impressed magnetic fields fluctuating at harmonics of the gating frequency may cause significant errors in measurements made with flux-gate magnetometers. These errors are demonstrated theoretically and experimentally. A passive method of reducing these errors is described and experimentally shown to provide a 400-to-1 reduction of errors resulting from fields fluctuating at the gating frequency. Author

N64-31730* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
AN INSTRUMENT FOR ELECTRONIC DIFFERENTIATION OF CURRENT–VOLTAGE CHARACTERISTICS
Roman Krawec Washington, NASA, Oct. 1964 19 p refs
(NASA-TN-D-2161) OTS: $0.50

An instrument is described that is capable of electronically obtaining the first derivative of any current–voltage characteristic. Its operation is based on the principle of superimposing a small alternating voltage on the direct-current supply voltage and detecting the change in alternating current that this causes. The amplitude of the detected alternating-current signal is shown to be proportional to the derivative of current with respect to voltage. A comparison of this technique with some other methods is given, along with an example of the use of the instrument in analyzing Faraday cup data in a hot-cathode, magnetically confined discharge. Complete instructions for operation and calibration are included. Author

N64-31802 Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
LOGICAL TECHNIQUES FOR GLOTTAL SOURCE MEASUREMENTS Instrumentation Papers No. 48
John L. Ramsey Aug. 1964 18 p refs
(AFCRL-64-661; AD-606119)

This report describes a method of using a PDP-1 computer to reduce data from a very high speed motion picture that shows the human vocal cords during voicing and carries a visual representation of the electrical signal from a microphone held in front of the subject during the filming. The object is to get representations of the area of the glottis (the opening between the vocal cords) and the pressure amplitude of the acoustical signal as functions of time. The glottal area and the acoustical amplitude shown on each frame of the film are reduced to binary form and stored on magnetic tape, together with a set of coordinates representing the periphery of the glottis, all suitably identified. Each frame of the film constitutes a sample in time which is not uniform because of slight changes in camera speed. A second program interpolates the data to yield uniform samples in time, normalized and properly scaled for presentation on the computer scope. A third program displays the data from the paper tape as two curves, one above the other, which drift slowly across the scope face. New data are added and old data discarded so that the drift is forward in time. Author

N64-31810 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
OBSERVATION OF 2,1 CHARGE TRANSFER IN A TOF MASS SPECTROMETER Physical Sciences Research Papers No. 39
W. W. Hunt, Jr. and K. E. Mc Gee Jul. 1964 15 p refs Presented at the Southwestern Meeting, Am. Phys. Soc., Tucson, Ariz., 28 Feb. 1964
(AFCRL-64-591; AD-605814)

The drift tube of a time-of-flight mass spectrometer has been adapted to serve as a reaction–collision chamber for studying ion dissociation reactions and charge-changing collisions. The methods for identifying the products of such processes depend on shifts in flight times produced by symmetric potential barriers, and are normally used in studying processes in which the mass-to-charge ratio (m/q) of the charged product particle is less than that of its parent. Processes in which the m/q of a charged product is greater than that of its parent represent an interesting special case, since the behavior of the product particle is quite different from that normally encountered. To illustrate this behavior, experimental observations of the 2,1 charge transfer process $N_2^{++} + N_2O = N_2^{+} + N_2O^{+}$ at 6000 eV are presented. Author

N64-31825 Rocketdyne, Canoga Park, Calif.
TOTAL IMPULSE MEASURING SYSTEM FOR SOLID-PROPELLANT ROCKET ENGINE, PHASE I REPORT
V. C. Plane Edwards AFB, Calif., AF Rocket Res. Labs., Jun. 1963 152 p refs
(Contract AF 04(611)-8515)
(R-5162; RPL-TDR-64-108; AD-605583)

Discussion and results of the three main considerations comprising the initial effort include the following: (1) study and discussion of the use site and existing measurement system; (2) general and applied mathematical analyses of spring-mass total impulse measurement systems; and (3) mechanical and electrical design of the system to be constructed. Author

N64-31826 Rocketdyne, Canoga Park, Calif.
TOTAL IMPULSE MEASURING SYSTEM FOR SOLID-PROPELLANT ROCKET ENGINE Installation and Operation Handbook
V. C. Plane Aug. 1964 45 p
(Contract AF 04(611)-8515)
(RPL-TDR-64-111; AD-606515)

A general description of the total impulse-measuring system is presented. The following are discussed with respect to installation and operation: overall test stand and calibrator; control-room equipment; precalibration operations; calibrations; and integration of motor thrusts. The following are discussed in the detailed component descriptions section: concrete abutment and support bases; load cell assembly; calibration system; load cell power supply; bridge balances; and integrating digital voltmeter. P.V.E.

N64-31846 Iowa State U. of Science and Tech., Ames Iowa Engineering Experiment Station
FAST RESPONSE INSTRUMENTATION FOR THE MEASUREMENT OF TURBULENT FLUXES IN THE LOWER ATMOSPHERE, AND A FILM READER SYSTEM AND ANALOG STATISTICAL ANALYZER Final Report
Robert W. Johnson, James E. Lucas, H. Tracey et al 1 Feb. 1964 128 p refs
1 Feb. 1964 128 p refs
(Contract AF 19(604)-5457)
(AFCRL-64-147; AD-604881)

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1. ERROR ANALYSIS OF TURBULENT FLUX MEASUREMENTS J. H. Tracey and R. M. Stewart, Jr. p 1–20 refs (See N64-31847 23-15)
2. DESIGN CONSIDERATIONS FOR A SHORT-PATH OPEN-SAMPLE INFRARED HYGROMETER R. E. Post and J. E. Lucas p 21–58 (See N64-31848 23-15)
3. A GATED CONTINUOUS-WAVE TWO-HEAD SONIC ANEMOMETER R. W. Johnson and R. M. Stewart, Jr. p 59–86 refs (See N64-31849 23-15)
4. A FILM TRANSPORT AND ANALOG STATISTICAL ANALYZER J. R. Edwards, R. E. Post, and R. M. Stewart, Jr. p 87–124 refs (See N64-31850 23-15)

N64-31847 Iowa State U. of Science and Tech., Ames Iowa Engineering Experiment Station
ERROR ANALYSIS OF TURBULENT FLUX MEASUREMENTS
J. H. Tracey and R. M. Stewart, Jr. *In its* Fast Response Instrumentation for the Meas. of Turbulent Fluxes in the Lower Atmosphere, and a Film Reader System and Analog Statist. Analyzer 1 Feb. 1964 p 1–20 refs (See N64-31846 23-15)

This report is concerned with computing the eddy fluxes of momentum, heat, and water vapor, and with providing expressions for determining the accuracy of the computations. Although this report is concerned primarily with eddy-flux measurement, a measure of total flux is required for some meteorological problems. The sonic anemometer and infrared hygrometer are not suitable for measurement of absolute magnitudes however. Eddy flux is somewhat dependent on the size of domain under consideration. A.W.

N64-31848 Iowa State U. of Science and Tech., Ames Iowa Engineering Experiment Station
DESIGN CONSIDERATIONS FOR A SHORT-PATH OPEN-SAMPLE INFRARED HYGROMETER
R. E. Post and J. E. Lucas *In its* Fast Response Instrumentation for the Meas. of Turbulent Fluxes in the Lower Atmosphere, and a Film Reader System and Analog Statist. Analyzer 1 Feb. 1964 p 21–58 (See N64-31846 23-15)

The major problem in developing an infrared absorption hygrometer is the detection system. Conductance must be controlled. "Spot cooling" with a thermoelectric cooler was shown to be the best control because of the effect that temperature has on a photoconductor. The experiment showed that as temperature decreases, detector conductance decreases for a fixed value of illumination. Regardless of the detector temperature, however, the conductance-intensity characteristic can be represented by a linear relationship for a range of intensities. This relationship is plotted graphically in the report. A.W.

N64-31849 Iowa State U. of Science and Tech., Ames Iowa Engineering Experiment Station
A GATED CONTINUOUS-WAVE TWO-HEAD SONIC ANEMOMETER
R. W. Johnson and R. M. Stewart, Jr. *In its* Fast Response Instrumentation for the Meas. of Turbulent Fluxes in the Lower Atmosphere, and a Film Reader System and Analog Statist. Analyzer 1 Feb. 1964 p 59–86 refs (See N64-31846 23-15)

The primary objective of the work has been the development of an instrument suitable for making velocity measurements under conditions that will be strongly influenced by small-scale velocity turbulence. This report describes a sonic anemometer designed to satisfy the above requirements. The device employs two electroacoustic transducers that are mounted facing each other at a distance of 40 centimeters. These transducers alternately transmit and receive sound pulses of an ultrasonic frequency, and the received signals are phase-detected with respect to a common reference. The two resulting output signals are proportional to the transit times required by the sound pulses to traverse the path between the transducers. These transit times are, when properly interpreted, a measure of the component of wind velocity along the sound path. Author

N64-31850 Iowa State U. of Science and Tech., Ames Iowa Engineering Experiment Station
A FILM TRANSPORT AND ANALOG STATISTICAL ANALYZER
J. R. Edwards, R. E. Post, and R. M. Stewart, Jr. *In its* Fast Response Instrumentation for the Meas. of Turbulent Fluxes in the Lower Atmosphere, and a Film Reader System and Analog Statist. Analyzer 1 Feb. 1964 p 87–124 refs (See N64-31846 23-15)

Although the system described was designed specifically for use in the study of atmospheric properties, the only restriction on its use is that the input data be in the form of a width-modulated 35-mm film strip. In this system, the frequency shift is accomplished by recording the data on film with a film speed of the order of 1 ft/min and analyzing it with a film speed of about 40 fps. A photomultiplier detects the amount of light transmitted through the moving film. Conventional

electronic systems analyze the output of the photomultiplier circuits. The complete system has two channels that can be interconnected in various ways to obtain the following functions: variance, covariance, autocorrelation, crosscorrelation, power spectrum, cospectrum, and quadrature spectrum. Author

N64-31851 Joint Publications Research Service, Washington, D.C.

IZVESTIYA VUZov: INSTRUMENT BUILDING, NO. 3, 1964 23 Sep. 1964 166 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 3, no. 3, 1964 p 3–136

(JPRS-26528: TT-64-41786) OTS: $5.00

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20. THERMOSTATIC CONDITIONING OF RECTIFIERS WHEN MEASURING THE DISTRIBUTION OF THE POTENTIAL V. A. Dorin and R. A. Solov'yev p 136–139 ref (See N64-31871 23-15)

21. TRANSMISSION OF OSCILLATIONS THROUGH A RUBBER NON-LINEAR SHOCK ABSORBER UNDER IMPACT V. S. Novoselov and A. Yu. L'vovich p 140–146 refs (See N64-31872 23-15)

22. APPLICATION OF THE METHOD OF DIFFERENTIAL COMPLEX FOR INVESTIGATION OF FLAT ENGAGEMENTS Ye. V. Blinnikov p 147–149 ref (See N64-31873 23-17)

23. DESIGNING THE MOVABLE SYSTEM FOR A TRANSDUCER PICKUP ELEMENT M. A. Bel'for p 150–153 ref (See N64-31874 23-15)

24. EXAMINATION OF CUTTING PROCESS BY END-CUTTERS OF SMALL DIAMETERS H.-C. Hsi p 154–158 (See N64-31875 23-17)

N64-31853 Joint Publications Research Service, Washington, D.C.

VOLT AMPERE CHARACTERISTICS OF THE DETECTOR AS A FACTOR DETERMINING THE ERRORS IN MEASUREMENTS OF THE EFFECTIVE VALUES OF VOLTAGE L. I. Volgin *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 7–17 refs (See N64-31851 23-15) OTS: $5.00

Under examination are the errors in measurement of the effective values of voltages of random form as related to magnitude indexes of the volt-ampere characteristic of a detector when calibrating the instrument scale for the effective values of sinusoidal voltage. Formulas are prepared for calculating the errors of measurements for certain types of voltages. A graphic illustration of formulas is provided. Author

N64-31854 Joint Publications Research Service, Washington, D.C.

METHODS FOR ENLARGING THE ANGLE OF DEVIATION AND LINEARIZATION OF THE ELECTROMETER SCALE A. S. Grigor'yev and B. K. Grigorovskiy In its Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 18–20 (See N64-31851 23-15) OTS: $5.00

This article examines a method of enlarging the angle of deviation of an electrometer and the linearization of its scale by introduction of an electrical reactive moment, with the help of two additional electrodes and photoresistances. Author

N64-31855 Joint Publications Research Service, Washington, D.C.

MOVEMENTS IN A PROPORTIONATE EXTREME SYSTEM B. A. Aref'yev *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 21–28 refs (See N64-31851 23-15) OTS: $5.00

In order to regulate processes in inert objects with extreme characteristics, a regulator could be used whose performance speed is proportionate to the speed of the objects' output coordinate. The motions of an extreme inert system having such a regulator is considered. The following are considered with respect to the system: equations of motion, possible motions within the system, movements of the system in the absence of turbulence, and processes in a system subjected to intensive turbulences. P.V.E.

N64-31863 Joint Publications Research Service, Washington, D.C.
EFFECT OF VERTICAL OSCILLATIONS OF GYROSPHERE ON THE READINGS OF A GYROSCOPIC COMPASS OF M-3 TYPE
M. A. Sergeyev *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 80–86 refs (See N64-31851 23-15) OTS: $5.00

This article examines the effect of moments of inertia on the readings of terrestrial gyroscopic compasses of the type M-3, produced by changes in the location of the sensitive element in relation to height within the electrode sphere. The effect of the indicated forces has been examined as a factor in establishing lifting power. Author

N64-31865 Joint Publications Research Service, Washington, D.C.
INSTRUMENT FOR AUTOMATIC RECORDING OF AUTOMOBILE BEHAVIOR AT HIGH-ALTITUDES
P. L. Brail'chuk *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 93–96 (See N64-31851 23-15) OTS: $5.00

This article describes an instrument permitting automatic recording of the essential parameters of automobile motion in high altitude mountains. The recording is on paper tape. It is demonstrated that this instrument could be applied for road tests of automobiles, and also for tests connected with the design and construction of new automobiles. Author

N64-31866 Joint Publications Research Service, Washington, D.C.
SENSOR OF HIGH PRESSURE DROPS
O. A. Muravenko and S. G. Agadzhanyan *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 97–102 (See N64-31851 23-15) OTS: $5.00

This article describes the theoretical scheme of a sensor for high-pressure drops, based on a new principle of measuring. This principle is very simple and has high accuracy, universality, and convenience. Author

N64-31871 Joint Publications Research Service, Washington, D.C.
THERMOSTATIC CONDITIONING OF RECTIFIERS WHEN MEASURING THE DISTRIBUTION OF THE POTENTIAL
V. A. Dorin and R. A. Solov'yev *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 136–139 ref (See N64-31851 23-15) OTS: $5.00

In order to enlarge the scope of the instrument designed for measuring potential, an arrangement has been developed that thermostats the rectifier. With the help of this device it is possible to measure distribution of the potential in the intervals of temperature -30° C + 120° C. Utilizing this device a definition was obtained for TC DFV p-n transfer of the rectifier and TCL of the semiconductor layer. Author

N64-31872 Joint Publications Research Service, Washington, D.C.
TRANSMISSION OF OSCILLATIONS THROUGH A RUBBER NON-LINEAR SHOCK ABSORBER UNDER IMPACT
V. S. Novoselov and A. Yu. L'vovich *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 140–146 refs (See N64-31851 23-15) OTS: $5.00

The relative displacement and absolute acceleration of a solid body on a rubber shock absorber that is subjected to severe compression is investigated. The following are considered: (1) the forced movement of the measuring mechanism (a rigid body mounted on rubber); (2) determination of the maximum amplitude translation of the measuring mechanism in relation to the body of the instrument; and (3) the absolute acceleration of the measuring mechanism. P.V.E.

N64-31874 Joint Publications Research Service, Washington, D.C.
DESIGNING THE MOVABLE SYSTEM FOR A TRANSDUCER PICKUP ELEMENT
M. A. Bel'for *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 150–153 ref (See N64-31851 23-15) OTS: $5.00

In this article are presented mehods of calculation for a mobile system of sensing elements that preserve the initial position of a probing needle, regardless of the position of the transmitter in space. Author

N64-31937 Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska
CALIBRATION OF THE MERCURY STRAIN GAUGE
Charles J. Eagan Jun. 1964 16 p refs
(AAL-TDR-64-7; AD-605256)

Two methods are described for precise and convenient calibration of mercury strain gages used for the measurement of physiological functions. One method is best used in calibration for linear extension, and the other is most useful in mercury strain gage plethysmography. Author

N64-31945 Optics Technology, Inc., Belmont, Calif.
FIBER OPTICS IMAGE DEVICE Final Report, Apr. 1963-Jul. 1963
D. F. Capellaro Griffiss AFB, N.Y., RADC, Aug. 1964 29 p
(Contract AF 30(602)-2746)
(RADC-TDR-64-217; AD-606636)

The development of a fiber optics image device using the "cylindrical fibers redistribution system" is discussed. The program included the investigation of various fabrication techniques and the construction of equipment for the suitable manipulation of fiber layers to form an image device. Three fabrication techniques—rotating substrate, expanding substrate, and expanding–contracting—were investigated. Of these, the last method was fairly successful; however, it became apparent that a fundamental limitation exists in the nonuniformity of the expansion of elastic materials. Author

N64-31975 Rocketdyne, Canoga Park, Calif.
TOTAL IMPULSE MEASURING SYSTEM FOR SOLID-PROPELLANT ROCKET ENGINE, PHASE II REPORT
V. C. Plane Edwards AFB, Calif., AF Rocket Res. Labs., Mar. 1964 40 p
(Contract AF 04(611)-8515)
(R-5602; RPL-TDR-64-109; AD-606557)

The final effort was the construction of a total impulse measurement system whose static calibrations to date produced a standard deviation of 0.014%, and whose accuracy is directly traceable to dead-weight standards of 0.02% accuracy. Author

N64-32022 General Precision, Inc., Glendale, Calif. Surface Equipment Div.
STEREOPLOTTER, PROJECTION AP-14 Final Report, 10 Dec. 1962–15 Sep. 1963
P. M. Salomon Apr. 1964 97 p
(Contract AF 30(602)-1771)
(RADC-TDR-64-154; AD-606694)

The application of a raster servosystem to the areas of contour detection and tracing is considered from both a theoretical and an experimental point of view. The basic electronic systems required for such an instrumentation are considered in detail, and the limitations imposed by the existing instrumentation are discussed quantitatively. Experimental data, obtained with the aid of the prototype model constructed for this study, indicate that a raster servocontour tracing system provides a rapid and accurate means of extracting stereomodel contour information. Author

N64-32024 Frankford Arsenal, Philadelphia, Pa. Pitman–Dunn Labs.
HUMAN FACTORS STUDY OF DESIGN CONFIGURATIONS FOR THE LASER RANGE FINDER
A. Charles Karr and James T. O'Connor Feb. 1963 64 p
(R-1664; AD-298098)

An experiment was conducted to compare the accuracies of the proposed design configurations for the laser range finder (shoulder-operated vs bipod-mounted vs high tripod-mounted vs low tripod-mounted). The tripod-mounted configurations provided greatest accuracies. Following the experiment, the observers participated in nonstructured oral critiques of the design configurations, and completed a written questionnaire. The oral and written critiques attempted to elicit from the observers design preferences and design suggestions, considering combat conditions. A majority of the observers preferred the low tripod-mounted configuration and stated that this configuration would be the most practical in combat. A summary of the critiques is presented. Author

N64-32033 Aberdeen Proving Ground, Md. Ballistic Research Labs.
REFRACTIVE DEVIATION ERRORS OF INTERFEROGRAMS
G. D. Kahl and D. C. Mylin Jun. 1964 35 p refs
(BRL-1251; AD-447608)

The effect of refractive deviation on interferograms of cylindrical and planar disturbances has been investigated analytically by a ray tracing method. The results indicate the additional effects consist of three physically separable types: (1) deviation in the disturbance specimen only; (2) an amount caused by misfocusing, or the location of the observation plane with respect to the disturbance; and (3) a contribution from passing deviated rays through optically dense thick plates, such as windows. For most applications, the thick window effect is found negligible, especially when strongly deviated rays are excluded by the optical aperture. Applicable equations for typical experimental arrangements are given so the investigator can anticipate likely errors caused by deviation. Author

N64-32038 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
EDDY SHED HOT WIRE ANEMOMETER
Roy I. Glass, Jr. Sep. 1964 20 p refs
(ERDA-185; AD-447284)

This paper discusses the need for an accurate low-wind-speed measuring system for the White Sands Missile Range Wind Instrument Test Facility. It describes a device that has been installed in the facility and that operates on the principle of periodic eddy shedding on the down-wind side of a cylinder. Also presented is the special readout system developed for the device. Author

N64-32047 Texas Instruments, Inc., Dallas
MANUAL FOR POLYMODAL VOCODER, VOLUME III. SECTION VI: WIRING TABLE Final Report, Part Two
Aug. 1963 467 p
(AFCRL-63-301, Pt. 2; HB18-A63, Pt. 2; AD-420870)

Tables are presented that give the wiring of over 400 connectors and jacks for the Vocoder. Connectors and jacks are listed by location, drawer, and board, and various numbered pins in each connector are described by function and by other points of connections.

N64-32084 Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
A MULTIPURPOSE INSTRUMENT FOR ELECTROCHEMICAL STUDIES
R. C. Propst Jul. 1964 58 p refs
(Contract AT(07-2)-1)
(DP-903) OTS: $1.50

A multipurpose instrument was designed for investigating electrochemical phenomena by the following techniques: cyclic voltammetry, chronopotentiometry, chronoamperometry, controlled-potential and stepping coulometry, and controlled-potential, square-wave, single-drop, incremental-derivative, and Kalousek polarography. The design of the instrument is based on operational amplifiers and consists of a master chassis and 10 calibrated plug-in units. Each plug-in unit is designed for a particular technique. Circuits are included to perform synchronization and timing functions. Author

N64-32092 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
MILLIMETER RADIOMETER MEASUREMENT PROGRAM
Daniel J. Bruno Jul. 1963 39 p refs
(USAELRDL-TR-2353; AD-421501)

A measurement program was conducted to obtain, through the use of a passive detection system, basic data on the thermal contrasts from tactical military targets at 4.3 mm. A laboratory designed and constructed switched-type 4-mm radiometer enabled continuous comparison between the target or antenna temperature and that of a selected reference. The radiometer was calibrated to indicate temperatures hotter or colder than those of the chosen reference. Measurements were made at three beamwidths: 1° pencil beam, 12.5° × 15°, and 7° × 8.6°. With the information derived from this measurement program, it is now possible to design an airborne radiometer operating at 4.3 mm. Author

N64-32105 David Taylor Model Basin, Washington, D.C.
PRESSURE SENSITIVITY OF ACCELEROMETERS
Fred Schloss Aug. 1963 12 p refs Presented at the 65th Meeting of the Acoustical Soc. of Am., N.Y., 15–18 May 1963
(DTMB-1764; AD-420586)

The pressure sensitivity of accelerometers was determined in the frequency range from 20 to 6000 cps by immersing the transducer in a vibrating column of liquid as suggested by Sykes. If the sensitive axis of the transducer is oriented perpendicular to the axis along which the liquid column vibrates, the transducer will remain at rest, since the pressure gradient along the sensitive axis of the transducer is zero. The pressure sensitivities thus obtained are lower than the acoustic sensitivities obtained in air using other methods. Various aspects are discussed, such as the frequency dependence of the pressure sensitivity and the pressure sensitivity of cables. Author

N64-32146 Edison (Thomas A.) Industries, West Orange, N.J.
DEVELOPMENT OF A LOW COST GAMMA RADIATION SURVEY METER Final Report
L. G. Figular 1 Mar. 1964 109 p refs
(Contract OCD-PS-64-13)
(AD-447857)

This report covers the investigation and development of a new low-cost gamma radiation survey meter with a range of 1 to 100 R/hr. A survey of existing gamma radiation detection transducers is presented, with special emphasis on comparing newer semiconductor types with the new radiation detection type. Theory of operation and characteristics of the radiation detector are given, as well as results of preliminary gamma irradiation tests. Tests showed the tube to be fairly linear over a radiation level from 1 R/hr to 100 R/hr with no blocking or saturation up to 2000 R/hr. Development of low-cost reliable electronic circuitry is described for providing the 800-V dc operating voltage from two "D"-size flashlight batteries.
Author

N64-32224* Argonne National Lab., Ill.
SPARK CHAMBER AND MAGNET SYSTEM FOR PHOTOGRAPHING COSMIC-RAY TRACKS AT BALLOON ALTITUDES
James A. De Shong, Jr., Robert E. Daniels, Roger H. Hildebrand, and Peter Meyer (Chicago U.) Repr. from Rev. Sci. Instr., v. 35, no. 8, Aug. 1964 p 1035–1039 refs
(Grant NsG-144)

A spark chamber system, consisting of five spark chambers and a deflection magnet, is used to photograph tracks of cosmic-ray electrons at 130 000 feet. Four trajectory spark chambers display the deflected particle track from which particle energy and sign may be determined for magnetic rigidities up to about 2 bV. A tantalum-plate spark chamber at the exit detects electrons by production of cascade showers. Author

N64-32240 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPARK COUNTER FOR RECORDING PARTICLES OF COSMIC RADIATION
M. I. Pak and Yu. T. Lukin 25 Aug. 1964 12 p refs Transl. into ENGLISH from Tr. Inst. Yadernoy Fiz., Akad. Nauk Kaz., (Alma-Ata), v. 6, 1963 p 105–111
(FTD-MT-64-45; AD-605242)

The construction of a large-area spark counter and an investigation of its sensitivity to determining the local place of passage of charged particles of cosmic radiation with energies of 10^{10} to 10^{12} eV are discussed. The spark counter is to operate jointly with an ionization calorimeter and photographic emulsions. It is shown that spark counter effectiveness depends not only on the electric field strength, but also on other design features of the counter. It was also concluded that a spark counter of an area of 23 × 34 cm^2 and gap magnitude of 1.5 mm is sufficient for use with an ionization calorimeter in doing research on particles of cosmic high-energy radiation.
P.V.E.

N64-32258 Texas U., Austin Defense Research Lab.
SOLION TRANSDUCERS FOR APPLICATION TO ATMOSPHERIC ACOUSTIC STUDIES
J. L. Collins and W. C. Richie *In* AERDA Atmospheric Acoust. Propagation [1964] p 85–107 refs (See N64-32254 23-23)

The principles behind the solion pressure transducer are outlined. The solion full-wave linear pressure detector is an electrochemical transducer that has the demonstrated ability to detect low-frequency, low-pressure, acoustic signals. A description of an infrasonic microphone, developed to house and protect a solion pressure transducer, is presented. Response curves for the microphone and its associated electronics are included. The microphone system has operated with lines more than 1000 feet long. Output signal-to-electrical noise ratios in excess of 40 dB have been obtained at the most sensitive settings.
P.V.E.

N64-32259 Ling-Temco-Vought, Inc., Anaheim, Calif. Research Center
LOW-FREQUENCY, LOW-NOISE MICROPHONE INSTRUMENTATION
John K. Hilliard *In* AERDA Atmospheric Acoust. Propagation [1964] p 109–128 (See N64-32254 23-23)

Design of both large and small microphones in a range from 12- to 0.16-inch diameter is discussed. Work is concentrated in achieving the widest possible frequency ranges and highest signal-to-noise ratios. The range of interest is −40 to +200 dBs. The following are discussed in particular: (1) acoustic filters; (2) low-frequency calibrations; (3) continuous monitoring systems; and (4) high-level sonic-power generation.
P.V.E.

N64-32260 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
DIFFERENTIAL BELLOWSPHONE CALIBRATOR
Donald B. Ricketts *In* AERDA Atmospheric Acoust. Propagation [1964] p 129–139 ref (See N64-32254 23-23)
(Contract DA-36-039-SC-87492)

A device (differential bellowsphone calibrator) used to determine the frequency- and phase-response characteristics of pressure-type microphones operating in the infra-audio-frequency region is discussed. The differential bellowsphone calibrator is a variation of the basic pistonphone. It was specifically designed for determining the frequency and phase response of infrasonic microphones, and has the following technical specifications: frequency—0.05 to 30 cycles per second; amplitude—0.5 to 20 dynes per square centimeter, peak to peak; power requirements—24 to 90 V dc; and generating means—differential bellows. Features that make the differential bellowsphone calibrator a practical device for calibration are these: (1) compactness and portability; (2) complete air tightness; (3) easy and adequate control of pressure and frequency of output; and (4) lack of adverse frictional or vibrational qualities.
P.V.E.

N64-32336 Joint Publications Research Service, Washington, D.C.
AN AIRCRAFT INSTRUMENT FOR MEASUREMENT OF THE DIMENSIONS AND CONCENTRATIONS OF LARGE PARTICLES IN CLOUDS AND PRECIPITATION

A. N. Nevzorov *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 82–93 refs (See N64-32328 23-21) OTS: $4.00

An aircraft-borne instrument for measuring cloud particles of any aggregate state with a radius of 50 microns or larger is described. The instrument measures the amplitude of the electrical pulses appearing at the load of a photomultiplier when particles pass through a plane beam of light. A block diagram of the instrument, calibration techniques, measurement errors, and experience with the instrument in flight are included. M.P.G.

N64-32337 Joint Publications Research Service, Washington, D.C.

INSTRUMENTS FOR MEASURING RAINDROP SIZES INSTALLED ON AN AIRCRAFT AND A RADIOSONDE

I. M. Imyanitov, V. V. Mikhaylovskaya, and B. F. Yevteyev *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 94–107 refs (See N64-32328 23-21) OTS: $4.00

Requirements of aircraft-borne instruments for measuring the drop-size distribution of precipitation particles are presented, and an acoustic-type instrument that satisfies these requirements is described. The instrument measures the voltage arising at the output of a microphone at the time of collision with a raindrop. Laboratory and flight-test calibrations of the instrument are discussed. M.P.G.

N64-32338 Joint Publications Research Service, Washington, D.C.

A METHOD AND INSTRUMENT FOR DETERMINATION OF THE MICROSTRUCTURE OF CLOUDS AND FOGS

K. S. Shifrin and V. I. Golikov *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 108–118 refs (See N64-32328 23-21) OTS: $4.00

An optical method for measurement of the microstructure of large-drop clouds and fogs is described. The microstructure is determined from the angular distribution of scattered light at small angles and then by computing the integral of the values of the optical thickness of the drop within the range of interest. Block diagrams of the instrument and the results of field tests are given. An analog computer is being developed that will be incorporated into the instrument to perform the necessary calculations. M.P.G.

N64-32339 Joint Publications Research Service, Washington, D.C.

AN IMPROVED METHOD OF MEASUREMENT OF THE STRENGTH OF THE ELECTROSTATIC FIELD AT THE SURFACE OF SPACECRAFT IN THE UPPER ATMOSPHERE

I. M. Imyanitov and Ya. M. Shvarts *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 119–128 refs (See N64-32328 23-21) OTS: $4.00

Measurements of the electrostatic field at the surface of spacecraft are useful in estimating the distortions in sensor measurements of the distribution of charged particles in the vicinity of the spacecraft, and in estimating the braking forces when satellites are used as geodetic reference points. The use of an electrostatic oscillator with a measuring plate, which is part of the surface of the spacecraft, and a shielding plate, which periodically shields the measuring plate from the surrounding space charge, is described. The generated current causes a voltage drop that is measured by a tube circuit. Design considerations to reduce interfering noise currents to acceptable limits are included. M.P.G.

N64-32416 Oak Ridge National Lab., Tenn.

A MINIATURIZED FISSION CHAMBER AND PREAMPLIFIER ASSEMBLY (Q-2617) FOR HIGH-FLUX REACTORS

D. P. Roux, E. Fairstein, S. H. Hanauer, G. C. Guerrant, and J. L. Kaufman Oct. 1964 17 p ref
(Contract W-7405-ENG-26)
(ORNL-3699) OTS: $0.50

An articulated assembly consisting of a fission chamber, a preamplifier, and flexible cables has been developed to meet the space and environmental requirements of high flux reactors. This assembly, which has an in-service life greater than 1 year and low noise-pickup performance, is particularly suited as part of a reactor counting channel. The entire assembly is waterproof and can operate continuously at a temperature of 100° C. Its maximum outside diameter is 3/4 in. and its maximum rigid length is 1 ft. Author

N64-32473 Massachusetts Inst. of Tech., Cambridge Instrumentation Lab.

[CONSTRUCTION AND TESTING OF GAS BEARING GYROSCOPES] Informal Monthly Letter Report No. 45, 1–30 Jun. 1964

Albert P. Freeman 15 Jul. 1964 6 p
(Contract NObs-78136)
(E-1612; AD-448764)

The major effort of the program was directed toward constructing and testing of gas-bearing gyroscopes. Special effort was made to increase the slew capability of the fifth gyroscope wheel package by grooving two chrome oxide inners 0.014 in. wide. An alternative method of heat exchange for the oil in the E-test station was adopted. It consists of tapping chilled water (−28° F) from a nearby air-conditioning unit and piping it directly into the heat exchange. A.W.

N64-32510 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PULSE-COMPRESSION THERMAL VACUUM GAUGE

J. Groszkowski 22 Jun. 1963 26 p refs Transl. into ENGLISH from Arch. Elektrotech. (Warsaw), v. 10, no. 3, 1961 p 763–782
(FTD-TT-63-151/1+2; AD-448626)

The problem of extending the measurement range of thermal conductance vacuum gages in the direction of lower pressures is highly attractive by reason of the numerous advantages these gages present in comparison with ionization vacuum gages, in which phenomena of sorption, desorption, and surging, as well as thermal decomposition of the vapor, occur. Projects are known that consist, in application for this purpose, of precompression by means of mercury or an elastic vessel. The presence of mercury vapor is a shortcoming of the first method, and the difficulties of degassing large areas and metal materials constitute a disadvantage of both methods. The pulse-compression thermal-conductance vacuum gage represents an attempt at solution of the problem. Author

N64-32525 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.

DEVELOPMENT AND TESTING OF AN ABLATION SENSOR FOR PHENOLIC-GRAPHITE HEAT SHIELDS

W. E. Welsh, Jr., and D. J. Spencer 15 Sep. 1964 50 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-173; TDR-269(4230-40)-5; AD-448955)

Three types of sensors were evaluated for possible use in the measurements of position and movement of internal degradation zones in phenolic-graphite heat shields. The intended

application of such measurements is in flight-testing of prototype reentry vehicles. Two of the sensor types were based on the chemical degradation of an insulating coating over a resistance wire; the third was based on the melting of a copper wire. Only the coated-twisted-wire type of sensor performed satisfactorily. Measurements of temperature and resistance histories and depth profiles were made. Author

N64-32532 Harry Diamond Labs., Washington, D.C.
SOME METHODS OF APPROXIMATING AN OMNIDIRECTIONAL ACCELEROMETER WITH MULTIPLE UNIAXIAL ACCELEROMETERS
William E. Ryan 15 Jul. 1964 43 p ref
(TR-1243; AD-605219)

An examination is made of several methods of approximating an omnidirectional response from an array of uniaxial accelerometers. Several electronic circuits that process the output signals from the accelerometers are described. Each system is analyzed for maximum error. Author

N64-32574 School of Aerospace Medicine, Brooks, AFB, Tex. Aerospace Medical Div.
AN IMPROVED GRADIENT LAYER ANIMAL CALORIMETER
Phillip D. Quattrone Sep. 1964 15 p refs
(SAM-TDR-64-53; AD-449444)

A rapidly responding gradient layer calorimeter for experimental animals is described. Monitoring radiant and evaporative components of heat loss is accomplished by separate heat exchange systems that employ thermoelectric heat flowmeters. Calibration and test results with the equipment show the following: the response to energy input is linear in both the radiant heat exchange system (calorimeter thermopile) and the evaporative heat exchange system (platemeter thermopile); the calorimeter thermopile signal is independent of the location of the heat source in the chamber, and when referenced to a cold junction temperature of 20° C; has a response of 0.0212 mV/gm cal/min; the platemeter thermopile has a response of 0.0159 mV/gm cal/min; when referenced to a cold junction temperature of 4° C; the automatic temperature-control systems for the calorimeter and platemeter provide ±0.01° C control at their respective temperatures; the noise-to-signal ratio is less than 1% for the calorimeter thermopile and less than 2% for the platemeter thermopile at thermal input levels comparable to those expected from the experimental animal. The applicability of computer techniques for data analysis is included. Author

N64-32578 Eon Corp., Brooklyn, N.Y.
A PORTABLE FIELD CALIBRATOR FOR RADIOLOGICAL SURVEY INSTRUMENTS WHICH OPERATE OVER THE RANGE FROM BACKGROUND TO 500 r/hr. Final Report
N. G. Anton, J. Peale, and S. Sturtz Jan. 1964 108 p
(Contract OCD-OS-62-101)
(AD-446447)

This report presents the results of a development program leading to the design and production of a prototype all-mechanical portable field calibrator for radiological survey instruments. Utilizing spent uranium as shielding material the calibrator contains a cesium-137 gamma source of 220 curies. Variation in dose rate is accomplished by means of a series of eight attenuator slides that are also fabricated of uranium. The range of obtainable dose rates is from 0.4 mr/hr to 1000 r/hr. The radiation beam is directed into a test chamber that is in the form of a 16-in. cube. Instruments to be calibrated are viewed directly through a large lead-glass window. The dose rate selector mechanism and interlock system for the access door employ a novel all-mechanical fail-safe design. A set of four probe wells containing cesium sources is provided for the calibration of dosimeters and instruments that utilize external probes. Author

N64-32607 Massachusetts Inst. of Tech., Cambridge
BASIC PRINCIPLES OF UNCONVENTIONAL GYROS
Derek Howard Baker and James Weatherspoon Harrill 22 May 1964 124 p refs
(Contract AF 33(657)-7668)
(AD-602197) OTS: $4.00

The basic principles of four representative unconventional gyros are developed. The force between the plates of a charged capacitor manifests itself as the basis for rotor support in the electrostatic gyro. The cryogenic gyro support is dependent on the unusual electric and magnetic behavior of metals at extremely low temperatures. The laser gyro utilizes high-frequency electromagnetic radiation instead of angular momentum to sense inertial rotations. The angular momentum of the nuclear gyro is that of subatomic particles of matter. Author

N64-32613 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ENGINEERING EVALUATION OF THE METEOROLOGICAL SATELLITE GROUND RECEIVING SYSTEM
Arnold C. Peterson May 1964 27 p refs
(TR-2460; AD-605924)

This report is an evaluation of the performance of the Meteorological Satellite Ground Receiving System (MSGRS) for Army use, based on a number of cloud-cover automatic picture transmissions (APT) received from the TIROS VIII satellite. From the pictures received and analyzed, it was determined that the pictures, on Polaroid film, were of excellent clarity and definition to be used for cloud-cover formation analysis. The sensitivity and gain of the MSGRS is more than sufficient to receive excellent pictures during the satellite's orbit from almost horizon-to-horizon, where the maximum range approaches 2000 miles. Comments on the operation of the angular tracking and picture-processing portions of the system are included in the report. Also discussed are corrected problem areas. Author

N64-32631* Battelle Memorial Institute, Columbus, Ohio
DEVELOPMENT OF A VAPOR-PRESSURE-OPERATED HIGH-TEMPERATURE SENSOR DEVICE Second Quarterly Report, Jun. 12–Sep. 11, 1964
J. R. Van Orsdel, G. E. Raines, and J. M. Allen 11 Sep. 1964 34 p refs
(Contract NAS3-5202)
(NASA-CR-50001; BATT-4673-T2) OTS: $2.00 fs; $0.80 mf

Initial studies of compatibility between candidate probe materials and liquid-metal charging fluids have been completed. Tungsten–3% rhenium–lead, tungsten–bismuth, and tungsten–25% rhenium-lead appear most attractive in decreasing order. The probe size of 1/8-in. i.d. × 1/4-in. o.d. × 1 1/2 in. long has been found satisfactory on geometrical considerations and by thermal analysis. A preliminary design study of the signal generating system directs future development to the null-point pneumatically balanced diaphragm. The effects of internal heat generation and radiative heat loss on response have been further elucidated. The time constant has been found to become increasingly higher at the highest temperatures. This characteristic would be encountered in any similar type of probe sensor such as a thermocouple. Author

N64-32660 Atomic Energy of Canada Ltd., Chalk River, Ontario
CONTINUOUS RECORDING OF WAVE PATTERNS ON A BODY OF EXPOSED WATER
S. P. Newbery (Inst. of Cancer Res.) and A. S. Coveart Aug. 1964 12 p
(AECL-2051) Available from Sci. Doc. Distrib. Office, Chalk River: $0.50

An apparatus is described that presents on a chart recorder the small wave motions occurring on a wind-agitated water surface. The detector drives a battery-powered radio transmitter, which is linked to a receiving station equipped with line-operated recording facilities. Author

N64-32679 General Dynamics/Astronautics, San Diego, Calif. Space Sciences Lab.
SPECTRAL SLIT WIDTH OF A SMALL PRISM MONOCHROMATOR
M. L. Streiff and C. C. Ferriso Aug. 1964 67 p refs
(Contract Nonr-3902(00); ARPA Order-237; Proj. Defender) (GD/A-DBE64-054; AD-448724)

The width of the slit function of an idealized prism monochromator has been calculated for two image intensity distributions at the exit slit—a uniform intensity as wide as the exit slit, and the intensity distribution resulting from diffraction in the image of a slit of infinitesimal width. The width of the slit function for the image intensity distribution of a finite slit with diffraction and noncoherent illumination is given in terms of these two distributions. The calculations are based upon the single-pass Littrow arrangement of the Perkin–Elmer 98 monochromator but may be applied to other configurations by a simple procedure. Graphs of the slit function width versus wavelength and wavenumber are given for each of the commonly used prism materials: NaCl, KBr, CaF_2, SiO_2, CsBr, CsI, TlBrI (KRS-5), and the glasses LF-2 and DF-2. Author

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-31341 Joint Publications Research Service, Washington, D.C.
PHARMACOLOGICAL CHARACTERISTICS OF SEVERAL PREPARATIONS
30 Sep. 1964 44 p refs Transl. into ENGLISH from Farmakol. i Toksikol. (Moscow), v. 28, no. 3, 1964 p 331–349, 362–367
(JPRS-26645; TT-64-41903) OTS: $2.00

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N64-31342 Joint Publications Research Service, Washington, D.C.
THE PHARMACOLOGY OF THE BRAIN STEM
N. A. Kharauzov *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 1–3 refs (See N64-31341 23-16) OTS: $2.00

The blinking response of various animals to administration of hydrobromic arecoline and to phenamine is discussed. The experimental data suggest a suppression of arecoline phenomena by cholinolithics (atropine, scopolamine, methyldiazile, and pentaphenom) and suppression of phenamine phenomena by aminazine and preparation IEM-336 (amide para-aminophenylacetic acid and meta-phenylisopropylamine). M.P.G.

N64-31343 Joint Publications Research Service, Washington, D.C.
PHARMACOLOGICAL RESEARCH IN HIGH-MOLECULAR ANTICOAGULANTS
N. V. Petryayevskaya and A. V. Valdman *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 4–11 ref (See N64-31341 23-16) OTS: $2.00

The relationship between molecular weight and duration of anticoagulant activity was established for the preparation Vinol-PK, a polymerization product of pelentan (neodicoumarin) and polyvinyl alcohol. The anticoagulant action was found to increase with increasing molecular weight, and the duration of the anticoagulant effect was found to increase with increased dosage. Single administration of the high-molecular weight fraction slowed down blood coagulation for 15 to 17 days; repeated administration at a 10-day interval was effective for a month. Intravenous and enteral administration of Vinol-PK were found to be equally effective. M.P.G.

N64-31344 Joint Publications Research Service, Washington, D.C.
ON THE EFFECT OF ANESTHESIA ON THE REACTION OF HYPOPHYSO-ADRENAL SYSTEM TO STRESS
E. R. Bagramyan *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 12–19 refs (See N64-31341 23-16) OTS: $2.00

The effect of urethan anesthesia on the concentration of ascorbic acid in the adrenal glands of rats was studied. Against the background of this anesthesia, the reaction of adrenal glands to the unilateral adrenalectomy, X-ray, and administration of ACTH was investigated. For comparison, the effect of nembutal and ether anesthesia was tested. Author

N64-31345 Joint Publications Research Service, Washington, D.C.

FORMS OF ADRENAL MORPHOPHYSIOLOGICAL REORGANIZATION FROM THE EFFECT OF STRONG "STRESSOR" AND HIGH ACTH DOSES

V. I. Prilutskiy *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 20–26 refs (See N64-31341 23-16) OTS: $2.00

During the action of a strong "stressor" and of large doses of ACTH on an organism, two quantitatively different forms of morphophysiological reorganizations are observed: (1) the entrance of the majority of the cells into active phases of the secretory cycle, and (2) an increase of the general mass of hormonopoietic elements instead of hypertrophy and hyperplasia, which is accompanied by the exit of a part of the cells from their active phases of the secretory cycle. The nature of the morphological reorganization of the adrenal cortex to a large degree depends on the intensity and duration of the action of the factors evoking it. Author

N64-31346 Joint Publications Research Service, Washington, D.C.

PHARMOCOLOGICAL CHARACTERISTICS OF TETRAMETHYLCYSTAMINE

Yu. E. Strel'nikov *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 27–33 refs (See N64-31341 23-16) OTS: $2.00

Further investigation of the pharmacological properties of tetramethylcystamine (TMC) was conducted. The tests were made on 20 cats, anesthetized with urethan. Arterial pressure was registered by a mercury manometer, connected to a common carotid artery, and respiration, with a Marrey's capsule connected to a trachea. Simultaneously the tonus of the third eyelid was recorded. The solutions of the preparation were injected into the vena femoralis. During an intravenous administration of TMC in 1 mg/kg dose a minimum hypotension and respiratory stimulation were observed. The effect increased with the increase of the dose. In doses of 40 to 50 mg/kg, TMC lowered the blood pressure to 40 to 50 mm. Hypotension continued for 1 1/2 to 2 hours. Respiration first increased and became more rapid and later decreased to a complete stop.

Author

N64-31347 Joint Publications Research Service, Washington, D.C.

EFFECT OF URANIUM ON THE ALKALINE PHOSPHATASE OF SOME ORGANS OF RATS

I. V. Shust *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 34–35 (See N64-31341 23-16) OTS: $2.00

The effect of subcutaneous administration of a 0.15-mg dose of uranyl nitrate on the alkaline phosphatase activity of the liver, kidney, spleen, and heart muscle of rats was investigated. In all cases, a change in alkaline phosphatase activity resulted, followed by a return to normal about 10 days after cessation of uranium-salt administration. In heart muscle, the alkaline phosphatase activity at first increases in the nuclei of the myocardium but, after prolonged administration, the enzyme activity almost disappears. Prolonged administration causes a leukocyte infiltration in liver lobules and a decrease in the quantity of granulocytes in the spleen. The phosphatase activity of the remaining granulocytes becomes more intense. Atypical localization of phosphatase activity in the kidney is noted after prolonged administration, but the total activity remains at about the control level. M.P.G.

N64-31348 Joint Publications Research Service, Washington, D.C.

DISTRIBUTION AND REMOVAL OF B-MERCAPTOPROPYLAMINE AND TAGGED S^{35} FROM THE ORGANISM OF MICE

G. V. Kalistratov and Ye. F. Romantsev *In its* Pharmacol. Characteristics of Several Preparations 30 Sep. 1964 p 36–41 refs (See N64-31341 23-16) OTS: $2.00

The β-mercaptopropylamine (MPA) was synthesized and in tests with small laboratory animals was found to be a more effective remedy against lethal doses of ionizing radiation than β-mercaptoethylamine. The goal of this investigation was to study the dynamics of the distribution of β-mercaptopropylamine through the organs and tissues of mice under normal conditions and after irradiation with X-rays of lethal doses. In addition, the effect of removal of MPA from the urine and feces of healthy and irradiated animals, and the presence in the urine of mixed, nonorganic, and ether-combined sulfur were studied. Author

N64-31445* National Aeronautics and Space Administration, Washington, D.C.

"ANILINE POISONING"—GASTRIC LAVAGE—WATER INTOXICATION ['ANILINFORGIFTNING—MAGSKOLJNING—VATTENFORGIFTNING']

Stig Sjolin Aug. 1964 7 p refs Transl. into ENGLISH from Nord. Med. (Stockholm), v. 46, 1951 p 1494–1495 (NASA-TT-F-9056) OTS: $1.00 fs; $0.50 mf

Because of the high toxicity of aniline, the treatment generally followed in Sweden for children known to have sucked or chewed on an aniline pencil was gastric lavage and thorough cleaning of the oral mucosa. This paper reappraises the question. The aniline found in aniline pencils is not identical with true aniline; it consists of triphenylmethanes or, more precisely, pararosanilines. The toxicity of this substance is low, although in high concentration it has irritating effects. It is suggested that the symptoms attributed to sucking on aniline pencils are more readily accounted for by water intoxication due to the absorption of excessive quantities of water during gastric lavage. The omission of lavage and the substitution of suitable nourishment is advised in these cases. Because of the danger of water intoxication, it is suggested that physiological saline should always be used in gastric lavage. R.L.K.

N64-31457 Joint Publications Research Service, Washington, D.C.

REFLEX ACTION OF THE NERVOUS SYSTEM

16 Sep. 1964 126 p refs Transl. into ENGLISH of 8 articles from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 14, no. 2, 1964 p 195–222, 239–245, 277–300, 326–336 (JPRS-26427; TT-64-41685) OTS: $4.00

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1. INDIVIDUAL DIFFERENCES AS FACTORS IN THE RESPONSES OF BRAIN POTENTIALS TO RHYTHMICAL LIGHT STIMULATION V. D. Nebylitsyn p 1–16 refs (See N64-31458 23-14)

2. SOME PECULIARITIES OF MAN'S VOLUNTARY AND INVOLUNTARY EMOTIONAL REACTIONS P. V. Simonov, M. N. Valuyeva, and P. M. Yershov p 17–28 refs (See N64-31459 23-14)

3. CHANGES IN THE RELATIONSHIPS OF THE ORIENTING AND MOTOR CONDITIONED REFLEXES UNDER THE INFLUENCE OF ATROPINE E. A. Kostandov p 29-47 refs (See N64-31460 23-14)

4. THE PHYSIOLOGICAL SIGNIFICANCE OF SOUNDS OF THE HUMAN VOICE P. S. Shpakov p 48–63 refs (See N64-31461 23-14)

5. THE REPRESENTATION OF THE VISUAL ANALYSOR IN THE CORTEX OF THE CEREBRAL HEMISPHERES V. G. Skrebitskiy and Ye. G. Shkol'nik-Yarros p 64–82 refs (See N64-31462 23-16)

6. PATHWAYS FOR THE CONDUCTION OF PRIMARY SPECIFIC INFORMATION IN THE SYSTEM OF THE VISUAL ANALYSOR N. N. Lyubimov p 83–95 refs (See N64-31463 23-16)

7. INTERACTION OF THE EXCITATORY AND INHIBITORY PROCESSES IN THE ACOUSTIC ANALYSOR OF A DOG IN RESPONSE TO PURE TONES N. N. Lazuko p 96–105 refs (See N64-31464 23-16)

8. SOME DATA ON THE RELATIONSHIP BETWEEN SLOW AND IMPULSE ACTIVITY IN THE PALEOCORTEX OF THE LIZARD L. G. Voronin, K. G. Gusel'nikova and V. I. Gusel'nikov p 106–121 refs (See N64-31465 23-16)

N64-31462 Joint Publications Research Service, Washington, D.C.

THE REPRESENTATION OF THE VISUAL ANALYSOR IN THE CORTEX OF THE CEREBRAL HEMISPHERES

V. G. Skrebitskiy and Ye. G. Shkol'nik-Yarros *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 64–82 refs (See N64-31457 23-16) OTS: $4.00

The morphological connections of different regions of the cerebral cortex were compared with electrical responses evoked therefrom. The experiments were conducted on dogs in whom electrodes had been planted in different regions of the cerebral cortex. Some of the conclusions reached were these: Single light stimulations evoke in the cortical nucleus of the visual analyser a response, including both a primary component with a latent period of 15 to 25 milliseconds and a secondary component with a latent period of 30 to 50 milliseconds. Outside the cortical nucleus, primary reactions were pronounced in the medial suprasylvian gyrus. There are direct centripetal connections of the retina with the cortex. A.W.

N64-31463 Joint Publications Research Service, Washington, D.C.

PATHWAYS FOR THE CONDUCTION OF PRIMARY SPECIFIC INFORMATION IN THE SYSTEM OF THE VISUAL ANALYSOR

N. N. Lyubimov *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 83–95 refs (See N64-31457 23-16) OTS: $4.00

The investigation of the pathways was conducted on 15 dogs. At least three pathways were differentiated: the classic visual pathway from the retina; a supplemental pathway from the visual region of each hemisphere through the posterior section of the corpus callosum to the opposite visual center; and a well-developed neuronal system that switches over to the other side at the level of the midbrain and reaches the opposite cortical visual center. Responses may be associated with the propagation of an excitation over each of these pathways, over any two of them, or over all three. A.W.

N64-31464 Joint Publications Research Service, Washington, D.C.

INTERACTION OF THE EXCITATORY AND INHIBITORY PROCESSES IN THE ACOUSTIC ANALYSOR OF A DOG IN RESPONSE TO PURE TONES

N. N. Lazuko *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 96–105 refs (See N64-31457 23-16) OTS: $4.00

The effect was studied of pure tones of identical loudness, but of varying frequency, on four dogs with the ducts of their parotid glands exposed. Conditioned responses to tones were developed in all the dogs, as were certain inhibitory responses. A.W.

N64-31465 Joint Publications Research Service, Washington, D.C.

SOME DATA ON THE RELATIONSHIP BETWEEN SLOW AND IMPULSE ACTIVITY IN THE PALEOCORTEX OF THE LIZARD

L. G. Voronin, K. G. Gusel'nikova, and V. I. Gusel'nikov *In its* Reflex Action of the Nervous System 16 Sep. 1964 p 106–121 refs (See N64-31457 23-16) OTS: $4.00

Experiments were conducted on lizards that were immobilized with Diplacin. From test data, it was concluded, among other things, that various kinds of impulsations converge into individual neurons, arriving mainly along nonspecific polysynaptic pathways; and that the initial functional state of the animal is decisive in determining the character of the reaction to a stimulus of individual neurons. A.W.

N64-31471 Tennessee U., Oak Ridge Agricultural Research Lab.

RADIOBIOLOGY Semiannual Progress Report, 1 Jul.–31 Dec. 1963

Washington, AEC, Aug. 1964 136 p refs
(Contract AT(40-1)-GEN-242)
(ORO-624) OTS: $2.50

Results are reported on the status of animals surviving irradiation, the effects of radiation on the animal reproductive cycle, analyses of death patterns of irradiated animals, the physiological effects of whole-body irradiation, fission-product metabolism in animals and poultry, fission-product chemistry of soils, the biochemistry of fission-product elements, and the effect of penetrating radiation on plant tissue and the environmental factors modifying such effects. R.L.K.

N64-31535 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE POSSIBILITIES OF REPLACING THE NITROGEN IN THE AIR WITH HELIUM IN SPACE-VEHICLE CABINS AND THE EFFECTIVENESS OF USING A HELIUM–OXYGEN MIXTURE FOR VENTILATION OF A SPACE-PRESSURE SUIT

A. G. Dianov *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 224–236 refs (See N64-21522 23-29)

Two tests, lasting 22 and 30 days, were carried out on human beings. It was established that it is possible for a human being to spend a prolonged period of time (up to 25 days) in an airtight cabin in whose atmosphere the nitrogen of the air has been replaced by helium. In view of the high thermal conductivity of the helium–oxygen mixture, the zone of thermal comfort for the test subjects was a temperature range of 24.5° to 27.5° C during the day, and from 26° to 29° C at night. A change in the speech patterns of the test subjects was expressed in a shift of the speech spectrum toward frequencies higher by a magnitude of 0.7 of an octave. Author

N64-31536 Joint Publications Research Service, Washington, D.C.

PHYSIOLOGICAL RESEARCH IN THE USSR

17 Sep. 1964 64 p refs Transl. into ENGLISH from Fiziol. Zh., Akad. Nauk Ukr. RSR (Kiev), v. 10, no. 3, 1964 p 301–306, 308–312, 360–365, 379–382, 390–396, 403–411
(JPRS-26444; TT-64-41702) OTS: $3.00

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1. UNIVERSAL DEVICE FOR INPUT OF PHYSIOLOGICAL CHARACTERISTICS INTO AN ELECTRONIC COMPUTER K. O. Shkabara and Yu. S. Rubashov p 1–8 refs (See N64-31537 23-16)

2. AN ALGORITHM FOR ANALYZING THE IMPULSE ACTIVITY OF NEURONS WITH AN ELECTRONIC COMPUTER M. V. Yarovits'kyy p 9–15 refs (See N64-31538 23-16)

3. SOME PROBLEMS OF THE ADAPTATION OF THE ORGANISM TO CHRONIC OXYGEN STARVATION V. I. Voytkevich p 16–24 refs (See N64-31539 23-16)

4. EFFECT OF CENTIMETER- AND METER-RANGE ELECTRO-MAGNETIC WAVES ON THE CONTENT OF BIOLOGICALLY ACTIVE SUBSTANCES IN HUMAN BLOOD E. L. Revuts'kyy and F. M. Eydel'man p 25–28 refs (See N64-31540 23-16)

5. VARIABILITY OF PRIMARY EVOKED POTENTIALS RECORDED UNIPOLARLY FROM THE SURFACE OF THE AUDITORY ZONE OF THE CORTEX OF A CAT IN THE STATE OF NARCOSIS O. F. Dembnovets'kyy p 29–32 (See N64-31541 23-16)

6. ORIGIN OF THE POSITIVE COMPONENT OF THE EVOKED POTENTIAL OF THE TECTUM OPTICUM OF THE TOAD E. O. Semenyuk p 33–36 refs (See N64-31542 23-16)

7. SPONTANEOUS MOTOR ACTIVITY IN CATS AND ITS RECORDING AND ALTERATION AFTER BILATERAL DESTRUCTION OF THE CAUDATE NUCLEI M. M. Oleshko p 37–40 (See N64-31543 23-16)

8. METHOD OF INVESTIGATING THE ELECTRICAL PROPERTIES OF NERVE AND MUSCLE FIBERS BY MEANS OF SURFACE EXTRACELLULAR ELECTRODES D. P. Artemenko and M. F. Shuba p 41–47 refs (See N64-31544 22-16)

9. ELECTROMETRIC AMPLIFIER DURING USE OF HIGH-RESISTANCE GLASS MICROELECTRODES V. F. Nikitenko, B. Ya. P'yatygors'kyy and Z. O. Sorokina p 48–51 refs (See N64-31545 23-16)

10. VARIATION IN THE METHOD OF INSERTING ELECTRODES IN ACUTE AND CHRONIC EXPERIMENTS A. P. Kobernik p 52–55 refs (See N64-31546 23-16)

N64-31537 Joint Publications Research Service, Washington, D.C.

UNIVERSAL DEVICE FOR INPUT OF PHYSIOLOGICAL CHARACTERISTICS INTO AN ELECTRONIC COMPUTER

K. O. Shkabara and Yu. S. Rubashov *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 1–8 refs (See N64-31536 23-16) OTS: $3.00

A device for taking recorded physiological characteristics and changing the data to a usable computer input is described. The device is designed to recreate information previously recorded on magnetic tape during physiological experimentation, to convert this information into binary code, and to introduce the information into the computer. Information in the form of discrete pulses (electrical activity of the neurons), registered with microelectrodes and continuous characteristics of the organism's physiological activity (electroencephalograms, blood pressure curves, respiration curves, etc.) is synchronously recorded on standard 6.3-mm magnetic tape for subsequent separate and joint analysis in the computer. Supplementary information is likewise recorded for insertion into the computer (the beginning and ending of stimuli, intervals during which analysis must be carried out, etc.). The device is comprised of a tape-transporting mechanism, three to five magnetic heads, a generator and time-pulse counter, a logic control circuit, and a power supply. P.V.E.

N64-31538 Joint Publications Research Service, Washington, D.C.

AN ALGORITHM FOR ANALYZING THE IMPULSE ACTIVITY OF NEURONS WITH AN ELECTRONIC COMPUTER

M. V. Yarovits'kyy *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 9–15 refs (See N64-31536 23-16) OTS: $3.00

This article describes a computer algorithm for analyzing the impulse activity of the central neurons. The impulse activity is considered as an unstable random stream of uniform actions with a periodic fundamental function. When some stimulus is applied to the organism—intravenous or intra-arterial injection of chemical agents, distention of the bladder, electrical irritants—a nonrandom aperiodic component is superimposed on the fundamental function and represents the cell's response to the stimulus. The fundamental function cannot be renewed with the impulse activity of the neuron. It can only be approached by plotting the frequency graph (change of frequency in time), which is the sum of the fundamental function and some unstable random process without an average value.

Author

N64-31539 Joint Publications Research Service, Washington, D.C.

SOME PROBLEMS OF THE ADAPTATION OF THE ORGANISM TO CHRONIC OXYGEN STARVATION

V. I. Voytkevich *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 16–24 refs (See N64-31536 23-16) OTS: $3.00

The adienorrhytic changes in the brain and the changes in the blood system during the adaptation of organisms to conditions of chronic hypoxia were studied. The study was conducted on white rats kept in hypoxia chambers and on human beings during a trip into a mountain area. It was established that the amount of blood in the brains of the rats increased and that the result of a 1-month's stay of the rats in hypoxia conditions resulted in an increase of blood in the brain by an average of 50 $\pm$1 to 73 $\pm$8 microliters per gram of brain (e.g., by 46%). In the human beings examined, the amount of hemoglobin in the peripheral blood increased by an average of 20% during a 2-month's sojourn in the mountains. In general, it is concluded that three of the more important defenses of an organism to hypoxia are these: (1) the appearance in the blood of a large number of hemopoietins; (2) an increase in the amount of blood in the brain; and (3) changes in the oxygen-binding properties of the hemoglobin. P.V.E.

N64-31540 Joint Publications Research Service, Washington, D.C.

EFFECT OF CENTIMETER- AND METER-RANGE ELECTROMAGNETIC WAVES ON THE CONTENT OF BIOLOGICALLY ACTIVE SUBSTANCES IN HUMAN BLOOD

E. L. Revuts'kyy and F. M. Eydel'man *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 25–28 refs (See N64-31536 23-16) OTS: $3.00

The blood histamine content and cholinesterase activity in 10 subjects were investigated before and after treatment with 22.12-m and 12.6-cm wavelength high-frequency electromagnetic radiation. It was found that the local application of a high-frequency electromagnetic field is accompanied by changes in blood histamine content and by a change in the activity of the specific cholinesterase of the erythrocytes. It was also established that the changes depend on the wavelength of the high-frequency electromagnetic field applied. The application of 22.12-m electromagnetic vibrations is accompanied by a decrease in the blood histamine content, while the activity of the specific cholinesterase of the erythrocytes remains unchanged. When 12.6-cm microwaves were applied, the blood histamine content remained unchanged, but

the activity of the specific cholinesterase of the erythrocytes increased. P.V.E.

N64-31541 Joint Publications Research Service, Washington, D.C.

VARIABILITY OF PRIMARY EVOKED POTENTIALS RECORDED UNIPOLARLY FROM THE SURFACE OF THE AUDITORY ZONE OF THE CORTEX OF A CAT IN THE STATE OF NARCOSIS

O. F. Dembnovets'kyy *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 29–32 (See N64-31536 23-16) OTS: $3.00

Study of the variability of primary evoked potentials (PEP) is important because their first positive phase on the surface of the cortex is considered an index of excitation in the depths of the cortex, and the negative phase is considered an index of excitation at the surface of the cortex. It was found that under certain conditions of stimulation, different PEP shapes may be recorded from the same spot in the cortex in the same specimen, up to the point where a PEP with a first positive phase is converted into a PEP with a first negative phase against a background of insignificant quantitative changes in the PEPs that originate at this time between different depth levels. From these results, it is concluded that primary evoked potentials recorded unipolarly from the cortical surface do not always correspond to the process that is provoked by the afferent impulses at the time between the different depth levels. P.V.E.

N64-31542 Joint Publications Research Service, Washington, D.C.

ORIGIN OF THE POSITIVE COMPONENT OF THE EVOKED POTENTIAL OF THE TECTUM OPTICUM OF THE TOAD

E. O. Semenyuk *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 33–36 refs (See N64-31536 23-16) OTS: $3.00

In the experiment discussed, the optical nerve of a toad was subjected to isolated rectangular stimuli of 0.5- to 1-msec duration. The evoked potentials were unipolarly recorded at the contralateral tectum opticum and registered on a cathode oscilloscope. Conclusions reached on the basis of the experiment include the following: (1) The slow waves of the evoked potential of the tectum opticum of the toad during stimulus of the optic nerve result from the algebraic addition in the recording electrode area of two components—the negative and the positive—each of which is composed of two slow oscillations. (2) The positive component in its pure form may be recorded from the center of the dorsal portion of the tectum opticum if its intrinsity activity is removed by local application of solutions of GABA, KCl, or alcohol; by local destruction of the area; or by depriving it of afferent impulses by transections. P.V.E.

N64-31543 Joint Publications Research Service, Washington, D.C.

SPONTANEOUS MOTOR ACTIVITY IN CATS AND ITS RECORDING AND ALTERATION AFTER BILATERAL DESTRUCTION OF THE CAUDATE NUCLEI

M. M. Oleshko *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 37–40 (See N64-31536 23-16) OTS: $3.00

A photoelectric method was used to study the number of motions of animals (cats of both sexes) before and after cutting their caudate nuclei. The spontaneous motor activity of nine cats (three before, and six before as well as after the operation) was studied. It was found that spontaneous motor activity increased after cutting the caudate nuclei by a factor of more than 10, as compared with maximum motor activity of the animals before operation, and that the activity increased by hundreds of times in the 2 days after destruction of the caudate nuclei. It is concluded that the increased spontaneous motor activity is directly linked to the destruction of the caudate nuclei and does not depend on season, sex, or previous administration of narcotics. P.V.E.

N64-31544 Joint Publications Research Service, Washington, D.C.

METHOD OF INVESTIGATING THE ELECTRICAL PROPERTIES OF NERVE AND MUSCLE FIBERS BY MEANS OF SURFACE EXTRACELLULAR ELECTRODES

D. P. Artemenko and M. F. Shuba *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 41–47 refs (See N64-31536 23-16) OTS: $3.00

A "sucrose bridge" method for measuring the membrane potential of a bundle of nerve fibers is discussed. The method consists mainly of the following. The section of the nerve between the recording electrodes is washed in a circulation isotonic sucrose solution with a high intrinsic resistance (10^6 ohm-cm). Through this procedure, the bypass effect of the surface layer of the fluid covering the nerve and the nerve fibers between the recording electrodes is so far diminished that the potential of the nerve may be measured at 80% to 90% of the true value of the membrane potential of the fibers. The measured value of the electric potentials equals their true value multiplied by a "short circuit factor" that is computed from the formula $R_p/(R_p + R_n)$, where R_p is the resistance of the external solution per unit of length, and R_n is the plasma resistance per unit of length. Equipment used in the application of the method is also described. P.V.E.

N64-31545 Joint Publications Research Service, Washington, D.C.

ELECTROMETRIC AMPLIFIER DURING USE OF HIGH-RESISTANCE GLASS MICROELECTRODES

V. F. Nikitenko, B. Ya. P'yatygors'kyy, and Z. O. Sorokina *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 48–51 refs (See N64-31536 23-16) OTS: $3.00

A two-tube amplifier for use with microelectrodes is described. An electrometric-type EM-4 triode is used as the input tube. This tube is chosen so that the current through the amplifier can be reduced to 10^{-13} A. The second stage is a balanced cathode repeater using a 6N3P tube. An electronic potentiometer with a 0 to 50μA indicator is used with the cathode repeater. To eliminate induction between the first and second stages, a low-frequency RC filter is inserted. The sensitivity of the whole unit is 0.25 mV per scale division of the self-scribing device. Its stability after a half-hour warmup is no less than 0.1 to 0.15 mV/hr. The effectiveness of the device was tested in an investigation of the activity of K and Na ions in the fibers of the sartorius muscles of toads. A brief description of the experiments is presented. P.V.E.

N64-31546 Joint Publications Research Service, Washington, D.C.

VARIATION IN THE METHOD OF INSERTING ELECTRODES IN ACUTE AND CHRONIC EXPERIMENTS

A. P. Kobernik *In its* Physiol. Res. in the USSR 17 Sep. 1964 p 52–55 refs (See N64-31536 23-16) OTS: $3.00

A method, using fast-setting plastic employed in making dental prostheses (styracryl) for fastening electrodes to the skull bone is described as follows. The head of the animal is made fast in a stereotaxic device. The surface of the skull is laid bare completely, and the points where the electrodes are to be inserted are marked. At the marked locations, trepanation apertures are bored through with a trepan. The dura mater is pierced with a needle. In order to make support pins to hold the electrodes in place, nests are made in the skull bone near

the trepanation apertures or around them in two or three places on the outer surface. The nests are drilled with two dental burrs. The drilling is carried out so as to maintain the lamina vitrea intact. Styracryl rolled into a little ball is pressed into the nest. After polymerization, the styracryl forms sturdy pins that can be joined into one ridge. The electrodes are inserted to the necessary depth and covered with mixed styracryl. The electrode and the first part of the lead soldered thereto are connected to the nearest support pin. P.V.E.

N64-31553* Naval School of Aviation Medicine, Pensacola, Fla.
LINEAR ENERGY TRANSFER SPECTRUM OF PROTON EXPOSURE ON MERCURY MISSION MA-9 Report No. 28
Hermann J. Schaefer 14 Jul. 1964 16 p refs
(NASA-Order R-75)
(NASA-CR-58948) OTS: $1.00 fs; $0.50 mf

The energy spectrum of astronaut proton exposure in the South Atlantic anomaly on Mercury mission MA-9 reported earlier is subjected to a detailed evaluation of the LET distribution of absorbed dose. It is found that the high LET fraction represents only a very small fraction of the total energy dissipation. Since this dose fraction requires, for the same amount of absorbed energy, a much smaller number of individual particles because of the high LET, a much larger emulsion volume has to be scanned for statistical significance. It is shown that this discrepancy in accuracy of total dose and high RBE dose is basic for all degraded continuous proton-energy spectra. The implications for the design of dosimetric instrumentation are discussed. Author

N64-31556 Joint Publications Research Service, Washington, D.C.
RESTORATIVE PROCESSES IN THE RADIATION INJURIES
M. A. Krayevskiy and A. V. Lebedinskiy, ed. 15 Oct. 1964 25 p refs Transl. into ENGLISH of 4 Excerpts from the book "Vosstanovitel'nyye Protsessy pri Radiatsionnykh Porazheniyakh" Moscow, Atomizdat, 1964 p 3–14, 89–95, 243–244
(JPRS-26921; TT-64-51177) OTS: $1.00

CONTENTS:

1. MECHANISM OF RESTORATION AT THE CELLULAR LEVEL FOLLOWING RADIATION INJURIES N. V. Luchnik, N. A. Poryadkova, L. S. Tsarapkin, and N. V. Timofeyev-Resovskiy p 3–12 refs

2. RESTORATION OF IMMUNOGENESIS IN IRRADIATED ANIMALS N. N. Klemparskaya and G. A. Shal'nova p 13–19 refs

N64-31557* Joint Publications Research Service, Washington, D.C.
TENSION AND EXPULSION TIMES FOR THE CARDIAC SYSTOLE AS A FUNCTION OF FREQUENCY IN CARDIOVASCULAR-NORMAL MAN [IL TEMPO DI TENSIONE E DI ESPULSIONE DELLA SISTOLE CARDIACA IN FUNZIONE DELLA FREQUENCZA NELL'UOMO AD APPARATO CARDIOVASCULARE NORMALE]
F. Penati and O. Simeoni Nov. 1963 23 p refs Transl. into ENGLISH from Arch. Sci. Med. (Torino), v. 77, 1944 p 121–146
(NASA Order W-11577-B-114)
(NASA-TT-F-8567) OTS: $1.00 fs; $0.50 mf

Behavior of tension and expulsion values as a function of frequency variations under normal cardiovascular conditions was studied. The author followed closely the Blumberger method of the Eden school, and discusses several other methods. Simultaneous recordings of EKG (making only electrical recordings of the 3 simultaneous tracks), phonocardiogram, and carotid sphygmogram were made, and the cardiac cycle frequency for each track was determined. Data of frequency variations obtained by various doses of Atropin, and also by physiological rhythmic variations, were compared to normal data. By formulation of equations expressing the correspondence between rise or drop of frequency, respectively, to drop or rise in tension and expulsion intervals, a reciprocal linear relationship between tension and expulsion was deduced. G.G.

N64-31829 Washington U., Seattle
RECIRCULATION OF LYMPHOCYTES
N. B. Everett, Ruth W. Caffrey, and W. O. Rieke Jul. 1964 18 p refs
(Contract AF 41(657)-309)
(AAL-TDR-63-17; AD-606684)

The long-lived small lymphocyte population of the rat includes approximately 90% of the cells that appear in thoracic duct lymph. About two-thirds of the small lymphocytes in blood are long lived. These long-lived cells are produced at a rate proportional to body growth and recirculate from blood to lymph. Although a major percentage of the small lymphocytes in lymph nodes and a smaller percentage of those in spleen are of the long-lived variety, the thymus may be their primary source of origin. The small lymphocytes in the bone marrow, approximately 95% of those in the thymus, and a major percentage of those in the spleen are short lived (five days or less). There is evidence that suggests the long-lived lymphocyte plays an active role in immune response mechanisms. Author

N64-31840 Joint Publications Research Service, Washington, D.C.
COMPARATIVE PHYSIOLOGICAL ACTIVITY OF GIBBERELLINS AND THE RELATION BETWEEN THE ACTIVITY AND STRUCTURE OF THE MOLECULE
G. S. Muromtsev 12 Oct. 1964 24 p refs Transl. into ENGLISH from Usp. Sovrem. Biol. (Moscow), v. 57, no. 3, 1964 p 447–492
(JPRS-26841; TT-64-51098) OTS: $1.00

The relation between physiological activity and chemical constitution of gibberellins and some of their derivates were studied. Gibberellins were isolated from fungus or plants and used as plant-growth regulators in order to interrupt dormancy; to stimulate growth; to develop acceleration; and to counteract, under certain conditions, external factors such as temperature or light. Diverse rearrangement of the basic molecular structure led to partial or complete inactivation of physiological activities. The presence of a lactone ring and of a free carboxyl group was found to be indispensible, and a methylen group was found to be essential. These characteristics were fulfilled in giberellin A_7, one of the most active compounds. G.G.

N64-31842 Air Force Systems Command, Wright-Patterson AFB, Ohio. Aerospace Medical Div.
HEIGHT-WEIGHT SIZING OF PROTECTIVE GARMENTS, BASED ON JAPANESE AIR SELF-DEFENSE FORCE PILOT DATA, WITH FIT-TEST RESULTS
Milton Alexander, John T. Mc Conville, (Antioch Coll.), James H. Kramer, and Eugene A. Fritz Jul. 1964 39 p refs Prepared jointly with Antioch Coll.
(Contract AF 33(657)-9201; AF 33(616)-6792)
(AMRL-TDR-64-66; AD-606039)

The sizing program is based upon an anthropometric survey of over 200 subjects. The statistical rationale used in devising the height–weight program is presented, along with the analysis of the anthropometric data. Two garments, the CSU–7/P Partial Pressure Assembly and the CWU–13/P Exposure Garment, were fabricated in accordance with the developed sizing program. The results of the fit tests served to validate the soundness of the basic survey data and the subsequent development of the height–weight sizing program. Author

N64-31886 Naval School of Aviation Medicine, Pensacola, Fla.
THE INCIDENCE OF PHYSIOLOGICAL SYMPTOMS IN HEALTHY MEN AFTER EXPOSURE TO RAPID DECOMPRESSION TO 43,000 FEET SIMULATED ALTITUDE
Arthur L. Hall 1 Sep. 1963 11 p refs
(RR-3; AD-447851)

Quantitative differences in symptomatology were not conclusive. The types of symptoms noted in the young male subjects in order of occurrence and severity were: gastrointestinal gas pain, aeroembolism, and middle ear pain. Stay at terminal altitude of 43 000 feet had to be prematurely terminated in 16.5% of the runs because of the appearance of such symptoms. On the basis of such a high rate of premature descents necessary under the experimental conditions, it was concluded that there is a possible danger to pilots flying at such altitudes in fighter-type aircraft. Author

N64-31927 Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
CARBON DIOXIDE MANAGEMENT. PART I: TECHNIQUE FOR CARBON DIOXIDE ABSORBER EVALUATION
John P. Allen Jun. 1964 42 p refs
(FDL-TDR-64-67, Pt. I; AD-605287)

A laboratory device was assembled for a closed air loop analysis of carbon dioxide removal agents. Lithium hydroxide, potassium hydroxide, soda lime, and molecular sieve 5A were used for establishing the adaptability and capability of this device for evaluation of other carbon dioxide removal agents. Carbon dioxide absorption curves from 1% and/or 5% carbon dioxide in laboratory air were obtained. Borax solution and amine solutions or solids showed some carbon dioxide removal capacity. Author

N64-31934 Utah U., Salt Lake City. Coll. of Medicine
EFFECT OF COLD EXPOSURE ON THE FORMED ELEMENTS OF MOUSE PERIPHERAL BLOOD
S. Marcus and F. Miya Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jun. 1964 27 p refs
(Contract AF 41(657)-311)
(AAL-TDR-63-23; AD-605258)

A search was made for a hematological parameter that might indicate when acclimatization to cold occurred in mice. The formed elements of mouse peripheral blood tested were total white blood cells and the absolute numbers of polymorphonuclear leucocytes, monocytes, lymphocytes, stress lymphocytes, and eosinophils. In addition the hematocrit, body weights, and adrenal gland weights were measured. No consistent changes between 21° and 2° C caged mice were observed with respect to the total WBC, PMN, stress lymphocytes, lymphocytes, and monocytes. Author

N64-31935 New Hampshire U., Durham
THE INFLUENCE OF HIBERNATION UPON EXPERIMENTAL INFECTIONS IN THE ALASKAN GROUND SQUIRREL
T. G. Metcalf and J. P. Schmidt Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Dec. 1963 8 p refs
(Contract AF 41(609)-1856)
(AAL-TDR-63-25; AD-605254)

Coxsackie virus infection occurred in both active and hibernating states by extension of virus into the tissues of ground squirrels following oral administration of virus. Virus was eliminated rapidly by the active animals but retained in tissue depots of hibernating animals for a lengthy period of time. The findings pose a question of whether the Alaskan ground squirrel could serve as a reservoir for the maintenance of microbiological forms of life in Arctic areas. Author

N64-31936 Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska
NATURAL MAMMALIAN HIBERNATION A Bibliography
William V. Mayer Jun. 1964 300 p
(Contract AF 41(657)-230)
(AAL-TDR-63-34; AD-605252)

N64-31942 Chicago Medical School, Ill.
EFFECTS OF WHOLE-BODY VIBRATIONS ON PLASMA AND URINARY CORTICOSTEROID LEVELS IN MAN Technical Documentary Report, Dec. 1960–Feb. 1963
Ben B. Blivaiss, Edward B. Magid, and Renato Litta-Modignani Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Jun. 1964 17 p refs
(Contract AF 33(616)-6889)
(AMRL-TDR-64-53; AD-606034) OTS: $0.50

The effects on the hypophysio-adrenal and hypophysio-thyroid systems of whole-body vibration of the human for three 3-minute exposures separated by 1 1/2-minute rest periods at 1 to 20 cps were assessed through the determination of plasma 17-hydroxycorticosteroids (17-OH-CS) and protein-bound iodine (PBI) and of urinary adrenal cortex steroids. The levels of vibration were estimated three-minute tolerance values for the various frequencies. Blood and urine samples were collected at corresponding times on the control day and on the experiment day. Plasma 17-OH-CS levels were lower than control values ($P < 0.05$) immediately after vibration at 5, 6, and 7 cps and at 5 hours after vibration ($P < 0.01$). There was a significant decrease in the urine excretion of the blue tetrazolium reducing steroids at 1, 2, and 3 cps, and in 17-ketogenic steroids at 18, 19, and 20 cps. At 5, 6, and 7 cps there were significant changes in all steroids studied. Author

N64-31943 Chicago Medical School, Ill.
ENDOCRINE AND METABOLIC RESPONSE OF DOGS TO WHOLE-BODY VIBRATION Technical Documentary Report, Dec. 1959–Feb. 1963
Ben B. Blivaiss, Renato Litta-Modignani, Giorgio Galansino, and Piero P. Foa Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Jun. 1964 19 p refs
(Contract AF 33(616)-6889)
(AMRL-TDR-64-54; AD-606054) OTS: $0.50

To determine the endocrine and metabolic response of restrained dogs to whole-body vibration, pentobarbital-anesthetized and nonanesthetized dogs were vibrated along the z axis while restrained in dorsal recumbency. After vibration of anesthetized dogs at either 4 cps and 0.4 g for 30 minutes or 2 hours, or at 10 cps and 2.3 g for 2 hours, there was an average increase of 4.08 mcg of 17 hydroxycorticosteroids (17-OH-CS) per 100 ml plasma and a significant increase in blood epinephrine, but not in serotonin or norepinephrine. Shaking at 4 cps and 1.7 g for 30 minutes produced less of a change in plasma 17-OH-CS than at 0.4 g. However, shaking at 4 cps

for 6 hours led to greater increase in plasma 17-OH-CS at 1.7 g than at 0.4 g. Nonanesthetized dogs shaken at 4 cps for 30 minutes had a greater increase of plasma 17-OH-CS than similarly shaken anesthetized dogs. Author

N64-31979 Aerospace Corp., El Segundo, Calif. Applied Mechanics Div.
THE EVALUATION AND APPLICATION OF CHEMICALLY REGENERATIVE ATMOSPHERIC CONTROL SYSTEMS
John W. Smylie 1 Jun. 1964 119 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-95; TDR-269(4560-50)-2; AD-604415)

This report presents a survey and analysis of carbon dioxide reduction, atmospheric regeneration systems. Emphasis was placed on inorganic chemical systems on the basis of availability, weight and power requirements, and compatibility with space vehicle design. The two most promising systems, methanization and carbonization (both utilizing hydrogen reduction of carbon dioxide into water and subsequent electrolysis of the water), were analyzed in detail and compared with other inorganic regeneration, biological, and open cycle systems. Both systems were evaluated, with major emphasis given to the interaction between the complete vehicle design and the carbon dioxide removal and oxygen supply systems. A set of penalty curves were derived showing the effects on takeoff weight of changes in the power penalty, leakage rate, water-recovery system efficiency, and use of byproducts from the carbon dioxide regeneration system. Author

N64-32016 Argentina Comision Nacional de Energia Atomica, Buenos Aires
THIN LAYER CHROMATOGRAPHIC SEPARATION OF VITAMIN D AND RELATED SUBSTANCES [SEPARACION CROMATOGRAFICA EN CAPA DELGADA DE VITAMINA D Y SUSTANCIAS RELACIONADAS]
A. E. A. Mitta, A. Troparevsky, and M. L. P. de Troparevsky 1964 7 p refs In SPANISH Presented at 8th Cong. Latinoam. De Quim., Buenois Aires, 1962 *Its* Informe No. 123

The separation by thin layer chromatography of mixtures of vitamin D, cholesterol, and products from the irradiation of the vitamin D precursors was studied. The results obtained indicate the possibility of securing a good separation of all the tested substances, with the exception of vitamins D_2 and D_3. All the solvents tried present practically the same R_f values. A quantitative evaluation of the D vitamins and of the cholesterol indicates, respectively, a recovery of 90% to 92% and 85% to 90%, which offers a good prospect for their quantitative determination in mixtures. Experimental procedures are described, and the data obtained are presented in a table.
Trans. by D.E.W.

N64-32018* Technisch Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague (Netherlands)
PROTECTION AGAINST THE BIOLOGICAL EFFECTS OF THERMAL RADIATION—A BIBLIOGRAPHY
J. W. Thiessen and J. Van Woerden Feb. 1963 105 p refs
(TDCK-33500)

This bibliography contains summaries of reports and articles on the physical characteristics of thermal radiation and radiation sources, on exposure, environmental, and skin factors influencing cutaneous burn production, and on the protective effects of fabrics, paints, creams, and other interposed materials. Material on mathematical analyses (prediction techniques) and retinal lesions is included. Whenever possible an annotation accompanies each bibliographical entry. The bibliography consists of 171 entries. Author

N64-32026 Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
THE REFRACTIVE ERROR AND INTRAOCULAR PRESSURE OF IMMATURE CHIMPANZEES UNDER SERNYL ANESTHESIA
Francis A. Young (Wash. State Univ., Pullman) and Donald N. Farrer Aug. 1964 10 p refs
(ARL-TDR-64-9; AD-445731)

Fifty chimpanzees, 29 males and 21 females ranging in age from 2 years old to 9 years old were refracted in the supine position under Sernyl anesthesia and Cyclogyl Cycloplegia. Intraocular pressures were obtained under the same conditions, and the results are summarized according to age, eye, and sex. Author

N64-32031 School of Aerospace Medicine, Brooks AFB, Tex.
RADIOPROTECTION WITH AET-CYSTEINE IN THE RHESUS MONKEY
George S. Melville, Jr., George V. Harrison, Jr., and Thomas P. Leffingwell Aug. 1964 13 p refs
(SAM-TDR-64-40; AD-448072)

A combination of radioprotective drugs, aminoethylisothiuronium dibromide (AET) and *l*-cysteine, was administered to *Macaca mulatta* monkeys before they received either 588 rad or 672 rad of X-radiation. Significant protection against mortality was observed at 588 rad for animals given AET-cysteine intravenously and for animals given AET-cysteine orally in conjunction with a sedative and postirradiation therapy. Protection was also observed at 672 rad for animals given both AET-cysteine intravenously and postirradiation therapy. Few differences in peripheral hematology were noted; however, changes in body weight and rectal temperature were less pronounced in treated animals at 588 rad than in untreated irradiated animals. Author

N64-32048* Brandeis U., Waltham, Mass.
THE COMPARATIVE ENZYMOLOGY OF TRIOSEPHOSPHATE DEHYROGENASE
William S. Allison (Cambridge U.) and Nathan O. Kaplan Repr. from J. Biol. Chem., v. 239, no. 7, Jul. 1964 p 2140-2152 refs *Its* Publ. no. 287.
(Grants NsG2375; NSF-G-14612; NIH CA-03611; AM. Cancer Soc. G-P-77F)

Procedures are described for the preparation of crystalline triosephosphate dehydrogenases from human heart muscle, beef, chicken, turkey, pheasant, halibut, and sturgeon skeletal muscle, and lobster tail muscle, as well as the procedure for a homogeneous preparation of triosephosphate dehydrogenase from *Escherichia coli*. The sedimentation constants of triosephosphate dehydrogenases isolated from 11 different species have been determined in 0.10_M sodium phosphate, pH 7.0. The electrophoretic properties of triosephosphate dehydrogenases isolated from 10 species have been compared on starch gels. The amino acid compositions of 11 triosephosphate dehydrogenases and their catalytic properties have been determined. The muscle enzymes crystallize with varying amounts of firmly bound diphosphopyridine nucleotide. Immunological cross reactions between rabbit antisera prepared against turkey, halibut, sturgeon, and lobster triosephosphate dehydrogenases and the homogeneous triosephosphate dehydrogenase from other species have been determined by quantitative complement fixation. Author

N64-32074 Rochester U., N.Y. Div. of Radiation Chemistry and Toxicology
ON THE POSSIBLE ROLE OF CRYSTALS IN THE ORIGIN OF LIFE

W. F. Neuman and M. W. Neuman 7 Aug. 1964 48 p refs
(Contracts W-7401-ENG-49; AT(30-1)-3287)
(UR-656)

It is postulated that two crystalline lattices, the silicates and the apatites, have the properties of surface adsorption and surface catalysis, which may have permitted them to play an important role in the origin of life on earth. In particular, they might concentrate monomers of biological interest, amino acids and nucleosides, and catalyzed dehydration reactions leading to phosphorylations and polymer formation. It was possible to show that apatite adsorbs a wide variety of monomers. Further, apatite was shown to function as a crude kind of chlorophyll, converting radiant energy, heat, or infrared irradiation to high-energy phosphate bonds in good yield. Adenosine was shown to be phosphorylated in the 5 position to AMP, and the process could be continued to the production of biologically active ATP. Chromatographic evidence was obtained, strongly suggesting that oligonucleotides were also produced. The significance of the results is discussed. Author

N64-32102 Arctic Health Research Center, Anchorage, Alaska
A METHOD OF DETERMINING THE POLLUTION OF SURFACE WATERS BY THE EGGS OF *ECHINOCOCCUS*
D. J. Baumgartner Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jul. 1964 8 p refs
(AAL-TDR-63-37; AD-606882)

A continuous upward flow sedimentation unit was developed to test surface waters at remote radar stations in Alaska for the presence of eggs of *Echinococcus*. Chlorination employed at these water supplies is not an effective protection. Many animals in these areas are infected with the tapeworm, and man can serve as a host for the larval form. Diagnoses of echinococcosis in the native population caused concern for health of Air Force personnel. Lack of early disease symptoms and unreliability of clinical tests necessitate physical surveillance of water supplies. Laboratory tests validated methodology. Author

N64-32115 Arctic Health Research Center, Anchorage, Alaska
TREATMENT OF UNDILUTED HUMAN WASTE BY THE ACTIVATED SLUDGE PROCESS
D. J. Baumgartner and C. F. Walters Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Mar. 1964 23 p refs
(AAL-TDR-63-36; AD-605257)

A laboratory-activated sludge system was operated to confirm field investigations indicating that a 423-gallon recirculating activated sludge system could adequately treat the undiluted human wastes from 10 men for at least six months and provide an effluent acceptable for use as a flushing fluid. In addition, the level and the effects of overloading were noted. The effect of high pH on odor production was observed, and the importance of pH control between 6 and 7 was demonstrated. The feed COD of 44 000 mg/l (BOD = 21 000 mg/l) was reduced by about 90% and the estimated water savings for toilet flushing was estimated at greater than 90%. Author
Author

N64-32144 Illinois U., Urbana
EXPERIMENTAL KETOSIS IN MAN—"COLD KETOSIS" COMPARED WITH POST-EXERCISE KETOSIS AND NUTRITIONAL KETOSIS Annual Progress Report
Robert E. Johnson and D. Phil 15 Oct. 1963 93 p refs
(Contract DA-49-193-MD-2222)
(APR-2; AD-422388)

This investigation was designed to answer three questions: (1) Does repetition of a ketosis following a 10-mile walk cause adaptive responses? (2) Does repeated exposure to cold result in a diminished ketotic response? (3) Do women show a post-exercise ketosis like men? Men and women both displayed a decreasing ketotic response as a result of repetitive exposure to exercise; and one out of four men showed a similar phenomenon with respect to adaptation to cold. Women displayed a postexercise ketosis similar to that shown by men, despite much individual variability. Prolonged moderate exercise, exposure to cold and starvation all produce similar metabolic effects. Author

N64-32163 Joint Publications Research Service, Washington, D.C.
HUMAN BIOCHEMICAL GENETICS
H. G. Hers 28 Sep. 1964 32 p Transl. into ENGLISH from Rev. Questions Sci. (Louvain), v. 24, 20 Jul. 1963 p 343–366
(JPRS-26577; TT-64-41835) OTS: $2.00

Ideas are reviewed that have emerged from genetic–biochemical research; their application to human medicine is stressed. Topics covered include the localization of man's genetic potential, the chemical nature and function of the gene, gene mutation, biochemical interpretation of recessiveness and dominance, sex-linked heredity, regulatory genes and operons, gene duplication, and the biochemistry of evolution. R.L.K.

N64-32164 Joint Publications Research Service, Washington, D.C.
BIOLOGICAL AND MEDICAL PROBLEMS RELATED TO THE DEVELOPMENT OF CHEMISTRY
V. Kh. Vasilenko and M. A. Zhukovskiy 12 Oct. 1964 12 p Transl. into ENGLISH from Klin. Med. (Moscow), v. 42, no. 6, 1964 p 3–8
(JPRS-26845; TT-64-51102) OTS: $1.00

A summary of the papers presented at the general meeting of the Academy of Medical Sciences U.S.S.R. (Feb. 3–7, 1964) is presented. The meeting was concerned with the utilization of the achievements of chemistry in the field of medicine. P.V.E.

N64-32165 Joint Publications Research Service, Washington, D.C.
THE CHEMICAL COMPOSITION OF THE UREA-EXTRACTABLE COMPONENTS OF THE PLAGUE VIRUS EV
L. S. Olenicheva 12 Oct. 1964 10 p refs Transl. into ENGLISH from Ukr. Biokhim. Zh. (Kiev), v. 36, no. 4, 1964 p 492–497
(JPRS-26858; TT-64-51115) OTS: $1.00

The use of urea to extract water-insoluble residue from the plague microbe EV is discussed. It was found that a 2.5 M solution of urea is a more active extractant for removing antigens from the water-insoluble residual of plague bacteria EV than is a 2.5% solution of sodium chloride. The qualitative chemical composition of ureic and salt extracts is similar, but in the ureic extracts there is a greater hydrocarbon content. The extracts that were studied represented a multicomponent system. Their basic mass consisted of simple and complex proteins—glycoproteids and nucleoproteids. P.V.E.

N64-32223* Aerospace Medical Div. Aerospace Medical Research Lab. (6570th), Wright-Patterson AFB, Ohio
PROTEIN-BOUND IODINE IN SERUM OF RATS BREATHING 99 PERCENT OXYGEN
Philip Felig, J. K. Goldman, and W. L. Lee, Jr. Repr. from Sci., v. 145, no. 3632, 7 Aug. 1964 p 601–602 refs
(NASA Order R-87)

Exposure of rats to 99% oxygen for 24 to 72 hr resulted in a significant fall in protein-bound iodine in serum. The fall was most prominent in the group treated for 72 hr and was not, however, associated with any detectable microscopic changes in thyroid structure. Author

N64-32225* Maryland U., Baltimore School of Pharmacy
THE COMPARATIVE BIOCHEMISTRY OF DEVELOPING *ASCARIS* EGGS. V: CHANGES IN CATALASE ACTIVITY DURING EMBRYONATION
L. C. Costello and W. Smith Repr. from Arch. Biochem. Biophys., v. 106, Jul. 1964 p 223–228 refs
(Grants NsG-436; NSFG-23313; PHS-G-DT-46)

Catalase activity was identified in homogenates of eggs of Ascaris lumbricoides varosuum. The specific activity of catalase (μmoles H_2O_2 decomposed per minute per milligram protein) was 30, 16, and 54 in the 1-cell first-stage larval, and second-stage larval eggs, respectively. The initial catalase activity observed in fertilized unembryonated eggs (1-cell) remained constant through cleavage and gastrulation until velopment of the first-stage larve, at which time activity markedly decreased (50%). When first-stage larvae molted to second-stage larvae, an immediate and marked increase (over 300%) in activity resulted. The relationship of catalase, cytochrome oxidase, and respiration in embryonating eggs is discussed. Catalase activity through all stages of embryonation was in great excess of theoretically formed H_2O_2, apparently serving as a protective mechanism against perioxide toxicity. Author

N64-32236 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEDICAL INVESTIGATIONS IN EASTERN ANTARCTIC
N. R. Paleyev 24 Jul. 1964 11 p Transl. into ENGLISH from Pervaya Kontinental'naya Ekspeditsya, 1955–1957, Nauchnye Rezul'taty (USSR) p 157–162
(FTD-TT-64-291/1; AD-605470)

Medical observations and measurements obtained on personnel at bases in the Antarctic and on ships in the area are discussed. The measurements were taken in an attempt to investigate the following problems: (1) Does the human organism experience any changes under conditions of long-term work in the Antarctic and, if so, what kinds of changes? (2) Are such changes dangerous to normal vitality of the organism? (3) What factors cause the changes? (4) How rapidly do these changes develop and how long are they preserved after leaving the Antarctic? P.V.E.

N64-32295 Kaiser Foundation Research Inst., Richmond, Calif. Lab. of Comparative Biology
STUDY OF PIGMENT SYSTEMS OF PHOTOSYNTHETIC ORGANISMS Final Report
Mary Belle Allen 28 Apr. 1964 6 p refs
(Contract AF 19(604)-6636)
(AD-602394)

A summary of work carried out in studying pigment systems of photosynthetic organisms is presented. Conclusions and results presented included the following: (1) The resolution of absorption spectra of cell suspensions is not improved by diffusers, such as opal glass, if a spectrophotometer receiving a large cone of light is used. (2) Electron spin resonance measurements on illuminated cells of *Chlorella pyrenoidosa* have shown the presence of two types of signal—a sharp, rapidly decaying one at g = 2.0030, and a broad (resolvable into five lines), slowly decaying one at g = 2.0046, with a line spacing of 5.5 gauss. (3) In *Chlorella pyrenoidosa* simultaneous illumination of the cells with light of two different wavelengths, absorbed by different pigment systems, results in a signal intensity that is less than the sum of the signals induced by the two light beams acting independently. (4) Work on the separation of the chlorophyll complexes of *Chlorella pyrenoidosa* has led to the isolation of a fraction with absorption maximum at 672 mμ, in contrast to the 678 to 680 mμ of the intact cell. P.V.E.

N64-32299 Naval Medical Research Lab., New London, Conn.
CRITICAL VISUAL AREAS OF EXPLOSIVE-ACTUATED LENS FILTER (ELF) SYSTEM FOR PREVENTION OF FLASH BLINDNESS
Kevin V. Laxar 15 Jan. 1964 9 p refs
(MR-64-1; AD-442740)

The adequacy of the field of view provided by the ELF helmet and visor system for scan of the instrument panel in operational Naval aircraft is discussed. The ELF helmet and visor system provides a visual field adequate for scan of critical instruments in the A-4 aircraft. Author

N64-32306 Joint Publications Research Service, Washington, D.C.
RADIATION PROTECTING ACTION OF CYANOGEN COMPOUNDS
V. D. Rogozkin, V. P. Belousov, and N. K. Yevseyeva 13 Oct. 1964 77 p Transl. into ENGLISH from the book "Radiozashchitnoye Deystviye Tsianistykh Soyedineniy", State Publishing House of Medical Literature Moscow, 1963 p 3-5, 7–23, 66–117
(JPRS-26887; TT-64-51144) OTS: $3.00

Discussed are investigations carried out to find agents that when given orally, would have a prophylactic effect in the case of acute radiation sickness, and at the same time, would not disturb the general condition of the organism and would not have unfavorable side effects. The following areas of the investigation are discussed: (1) compilation of brief data from literature on the use of cyanides and nitriles in severe radiation illness; (2) the results of preliminary research on the selection of protective preparations from the group of cyanophor compounds; (3) the protective action of amygdalin in severe radiation illness; (4) the effectiveness of amygdalin in severe radiation illness as compared to other radiation protective agents; and (5) aspects of the mechanism of action of amygdalin as a radiation protective agent. It was found that amygdalin has the most favorable effects among many known prophylactic agents, and that amygdalin provides a radiation-protecting action, when given orally long before irradiation, and possesses a broad therapeutic range. P.V.E.

N64-32308 Atomic Energy of Canada Ltd., Chalk River, Ontario
ANALYSIS OF EXTERNAL RADIATION EXPOSURES IN 1963
G. Cowper and P. C. Rowe May 1964 11 p refs
(ACEL-2050) Available from Sci. Doc. Distrib. Office, Chalk River: $0.50

An analysis of occupational radiation exposures received by employees has been carried out by machine accounting methods. Results are presented in tables and graphs. Author

N64-32324 System Development Corp., Santa Monica, Calif.
COMPUTER APPLICATIONS IN MEDICINE AND THE BIOLOGICAL SCIENCES Bibliography II
Sally L. Empey 28 Oct. 1963 36 p refs
(SP-1025/001/00)

N64-32326 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Inst. für Flugmedizin
THE INFLUENCE OF SHORT-TERM OXYGEN DEFICIENCY ON THE "ALKALI RESERVE" [DER EINFLUSS KURZFRISTIGEN SAUERSTOFFMANGELS AUF DIE "ALKALIRESERVE"]
Heinz Kunzmann Porz, DVL, May 1964 51 p refs In GERMAN; ENGLISH summary
(DVL-225) Available from Vereinigte Universitäts- u. Fachbuchhandlungen, R.-Wagner-Str. 1, Cologne, W. Germany

This article covers the evaluation of 34 short-term oxygen deficiency tests with regard to the changes in pH values, bicarbonate contents, and the carbonic-acid partial pressure of the human blood. Hyperventilation alkalosis and reduced carbonic-acid partial pressure were found in all persons, and an increased bicarbonate content was determined in 26.5% of test subjects, leading to the conclusion that some of the changes can be attributed to metabolic disturbances. G.G.

N64-32347 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (W. Germany) Institut für Flugmedizin
THE BIOLOGICAL EFFECT OF HIGH BLAST-FREE PRESSURE Report No. 1 [DIE BIOLOGISCHE WIRKUNG HOHER STOSSFREIER DRUCKBELASTUNG I. Bericht]
O. Wünsche Jul. 1964 27 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Deutsch-Französisches Forschungsinstitut St. Louis
(DVL-359; DLR-FB-64-06)

The possible death of living beings exposed to an air blast depends not only on the maximum pressure and impulse of the impacting wave but also on other factors of the pressure profile. Under slowly increasing pressures over a time of about 0.5 sec until the maximum pressure, stresses are tolerated that are nearly 10 times higher than those under fatal pressure blast. Starting from the biological effects of the pressure blast, this report presents experiments on albino rats that should determine the tolerance of high blast-free pressures up to 46 atm. The times of exposure on the highest pressure level were varied between 2 and 40 sec. The times of increasing and of decreasing pressure were kept constant. Author

N64-32350* Minnesota U., Minneapolis
PERIODICITY ANALYSIS: A POTENTIAL TOOL FOR BIOMETEOROLOGISTS
F. Halberg Repr. from Int. J. Biometeor., v. 7, Issue 2, 1963 p 167–191 refs
(Grants NsG-517; PHS-G-C-4359; PHS-G-NB-04531; Am. Cancer Soc. G-E-155)

In the study of physiological variations, the homeostatical approach leads to the treatment of the variations as random processes, and has the drawbacks of reliance on gross deviations for a description of the normal function, and of nondetection of physiopathological changes if the values are within normal range. Periodicity analysis uses normal rhythms rather than normal ranges as the reference standard. The methodology of periodicity analysis is presented for biometeorologists' evaluation of a physiological time series in which a broad spectrum of rhythms and near-rhythms are recognized and analyzed. The circadian component of variation is the most prominant; external and internal timing, synchronization, phase differences, and phase shifts in circadian systems are discussed in detail. D.S.G.

N64-32355 Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS. PART A: BIOSCIENCES Compilation of Abstracts
1 Sep. 1964 29 p refs
(ATD-P-64-52; AD-605550) OTS: $2.00 fs; $0.50 mf

Items selected from Soviet open literature and dealing with the following topics are discussed: (1) Space Medicine and Biology—"Decrease of the Effectiveness of the Protective Action of Cysteamine in Repeated Irradiation"; "Study of the Antiradiation Effect of Phenoxazine Derivatives"; "Effect of Prophylactic on Animals Subjected to External or Internal Irradiation"; "New Trends in the Study of Regeneration"; "Action Mechanism of Prophylactic and Therapeutic Complexes in Rats with Acute Radiation Sickness"; "Stimulating Effect of Serotonin on Hematopoiesis in Irradiated Rats"; and "Progress in Soviet Reanimatology"; and (2) Space Physiology—"The Effect of Decompression in Acute and Chronic Experiments"; "Effect of Hypoxia on the Coronary Circulation of Dogs"; "Effect of Proton and Gamma Radiation on the Functional State of the Vestibular Analyzer"; "On Mount Aragats"; and "Bioelectric Activity of Skeletal Muscles under Alternating Conditions of Overloads and Weightlessness. P.V.E.

N64-32356 Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS. PART A: BIOSCIENCES Compilation of Abstracts
2 Sep. 1964 29 p refs
(ATD-P-64-53; AD-605415) OTS: $1.00 fs; $0.50 mf

The abstracts are of papers selected from Soviet literature. Articles dealing with the following subjects are included: (1) Space Medicine and Biology—"Mechanism of the Antiradiation Effect of Cysteamine"; "Autoinfection (intestinal) in Radiation Sickness and Its Prevention in White Rats of the Wistar Strain"; "Radioprotective Effect of Diethylstilbestrol"; "Dynamic Biotelemetry"; and (2) "Space Physiology—Effect of Chemical Radioprotectors on Free Oxygen Concentration in the Brain and Bone Marrow of Rabbits"; "Content of the Catechol Hormones, Adrenaline and Noradrenaline, in Peripheral Blood during Moderate Hypothermia"; "Weightlessness and Artificial Gravity"; "Third Volga-Area Conference of Physiologists, Biochemists, and Pharmacologists"; and "Studies of Chemical Protection against Ionizing Radiation. I. Studies of the Toxicity of Sodium Cysteine Thiosulfonate to C_{57} Strain Black Mice." P.V.E.

N64-32376 Electro-Voice, Inc., Buchanan, Mich.
[COMFORT PROBLEMS IN SPACE ENVIRONMENTS—SPACECRAFT NOISE] Status Report No. 1
[1964] 6 p
(Contract AF 33(615)-1295)
(AD-442827)

Progress is reported on a project to reduce the acoustic noise in the Gemini capsule to a tolerable level. The acoustic noise facility was being activated, helmets and artificial heads were being procured, and various meetings and conferences were held. D.E.W.

N64-32377 Electro-Voice, Inc., Buchanan, Mich.
[COMFORT PROBLEMS IN SPACE ENVIRONMENTS—COMMUNICATION EQUIPMENT NOISE] Status Report No. 2
[1964] 11 p refs
(Contract AF 33(615)-1295)
(AD-442828)

The comparison of types of earphones and microphones was begun, and a survey of standard military and commercial earphones is summarized. Noise spectra in Mercury-type capsules are presented, and effects of various helmets and helmet designs on noise level are discussed. D.E.W.

N64-32379 Miami U., Coral Gables, Fla. Bascom Palmer Eye Inst.
HUMAN ELECTRORETINOGRAPHY AS A GAUGE OF VISUAL PERFORMANCE Annual Progress Report, 1 Jun. 1963–1 Jun. 1964
Thorne Shipley [1964] 67 p refs
(Contract DA-49-193-MD-2344)
(APR.-2; AD-448763)

The application of the ERG to children in nutritional surveys is felt to be its major strength. A new apparatus is described permitting the plotting of the change in the central scotoma as a function of time in the dark. A statistical analysis is presented of the ERG in 100 normal eyes. The question is raised concerning the possibility of false negative ERG responses. The Cordis portable apparatus was tested in the field, powered by a 12-V car battery, and it was found to be entirely satisfactory. A small sample of rare night-blind patients (three with entirely normal photopic acuity) has been obtained and extensively studied. Within that sample, a close correlation between adaptometric curves and the ERG was not found.
Author

N64-32400 School of Aerospace Medicine, Brooks AFB, Tex.
DYSBARISM
Harry F. Adler Feb. 1964 171 p refs *Its* Aeromed. Rev. 1–64
(AD-601600)

Definition and etiology of dysbarism, or "motion sickness," is given, with special attention to symptoms of decompression sickness from evolved or trapped gases; hypobarism and hyperbarism and associated conditions; Caisson disease; aeroembolism and aeroemphysema; and also use of the term "pompholyx." Theories of changes in the circulation and the formation of bubbles in altitude dysbarism are presented; the different systems are graded; and their effect is observed. The possible prevention of dysbarism by denitrogenation, selection of immune personnel, and the use of drugs as well as of pressure bag and pressure-cabin aircraft are discussed.
G.G.

N64-32407* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography, Jun.–Jul. 1964
Sep. 1964 140 p refs
(NASA-SP-7011(02)) OTS: $1.00

An annotated bibliography is given of unclassified reports and journal articles that were introduced into the NASA information system during June and July. This bibliography concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. These references were announced earlier in separate publications by NASA, the Library of Congress, and the American Institute of Aeronautics and Astronautics. The references are indexed by subject, corporate source, and personal author.
D.E.W.

N64-32410 Rome U. (Italy) Inst. of Pharmacology and Pharmacognosy
NEUROPHYSIOLOGICAL STUDIES OF BEHAVIOR
Gianfranco Ricci 1 May 1964 13 p refs
(Grant AF-EOAR-63-90)
(AD-601689) OTS: $1.00

Three short papers are presented on these subjects: behavioral and electroencephalogram modifications induced by anticholinergic drugs and their combination with amphetamine; modifications of cortical-evoked responses after administration of atropine and amphetamine; and studies on the modifications of the responses evoked in subcortical structures during avoidance-conditioning experiments with the monkey.
D.E.W.

N64-32480 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
A STUDY OF RATE-ANALOG PROCESSING METHODS FOR PHYSIOLOGICAL DATA
George W. Morton and Robert J. Rosov Wright-Patterson AFB, Ohio, AMRL, May 1964 17 p refs
(Contract AF 33(616)-10462)
(AMRL-TDR-64-10; AD-602983)

Often the most useful information contained in signals of physiological origin is the period or repetition rate of the waveform. This information is not directly apparent through inspection of the raw signal but must be derived by an additional counting or measuring operation. A review of methods of providing a direct indication of rate, including generating trigger pulses from periodic physiological waveforms and techniques for converting the wave-repetition period into a rate analog are presented. Particular attention is given to the electrocardiographic signals as a vehicle for demonstrating a recommended rate analog processor circuit.
Author

N64-32514 Trinity Coll., Dublin (Ireland)
[INVESTIGATION OF GENETIC INSTABILITY IN BACTERIA, PARTICULARLY WITH RESPECT TO THE PRESENCE OF CONTROLLING EPISOMES] Quarterly Technical Status Report No. 1, 1 Mar.–31 May 1964
G. W. P. Dawson [1964] 9 p refs
(Contract DA-91-591-EUC-3248)
(QTSR-1; AD-449207)

Three investigations of unstable strains of *Salmonella typhimurium* are reported. The first study confirmed the following earlier indications: (1) Auxotrophic reversions of pro-401 can be increased in frequency by innoculating the broth culture from a colony that has been stored for 10 to 14 days. (2) The spectra of reversions of pro-401 differ when the revertants are characterized after 3, 6, 10, and 14 days incubation after plating on enriched minimal medium. In the second study, an unstable leucine auxotroph, a clone of leu-151, is being examined to determine whether the genetic basis of the instability remains at the same site or is at different sites in different subcultures. The third study involves an attempt to describe the pattern of instability of the double auxotroph, tryA-1 leu-13.
M.P.G.

N64-32544 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEDICAL RADIOLOGY Selected Articles
28 May 1964 20 p refs Transl. into ENGLISH from Med Radiol. (Moscow), v. 8, no. 8, 1963 p 42–48, 54–58
(FTD-TT-64-329/1+2+4; AD-606768)

CONTENTS:

1. ON THE RELATION BETWEEN ARTERIAL PRESSURE CHANGES AND THE STATE OF CERTAIN REGULATING MECHANISMS IN THE EARLY PERIODS AFTER IONIZING RADIATION A. N. Lanin p 1–10 refs

2. THE EFFECT OF WHOLE-BODY ALPHA-IRRADIATION LIPOLYTIC ENZYME INDUCTION BY CONNECTIVE TISSUE CELLS F. L. Leytes p 11–17

N64-32583 Cantonal Hospital, Geneva U. (Switzerland)
EXPERIMENTS ON X-RAY PROTECTION Quarterly Technical Status Report No. 1, 1 Feb.–30 Apr. 1964
W. Jadassohn [1964] 4 p
(Contract DA-91-591-EUC-3238)
(Rept.-1; AD-491324)

Experiments with the vicia faba test, using substances allied to serotonin, showed that Indol and Indol acetic acid (heterauxin) had no protective effect against an irradiation of 400 r. Heterauxin demonstrated a slight sensitizing effect on the primary and secondary roots. Serotonin offered excellent protection if given before the irradiation; the protective results were doubtful if it was given immediately after the irradiation. The strong protective effect of hydrocortisone hemisuccinate against X-rays was confirmed, with sodium succinate and cyclohexanol hemisuccinate showing only slight protective effects. R.L.K.

N64-32602 Baylor U., Houston, Tex.
INFLUENCE OF COOLING OF ADJACENT AREAS ON GSR AND BASE RESISTANCE OF AN ISOTHERMAL SITE
Brooks AFB, Tex., USAF School of Aerospace Med., Sep. 1963 11 p refs
(Contract AF 41(609)-1527)
(SAM-TDR-63-70; AD-448770)

In a simulation of possible field conditions, skin resistance (R) and galvanic skin response (GSR) were measured from finger sites maintained at constant temperature, while adjacent areas were cooled and rewarmed. Cooling of restricted areas up to 10 cm from the isothermal site produced negligible changes in R and variable effects on GSR amplitude. Cooling the entire hand surface to 15° C caused an initial increase in GSR amplitude followed by a steady decline to levels as much as 50% below control while R showed only minor changes. GSR count was also altered. Results are interpreted in terms of a two-component system influencing R and GSR. It is concluded that adequate technique demands maintenance of a narrow temperature range over the entire hand or foot. Author

N64-32626 Air Force Systems Command, Wright-Patterson AFB, Ohio Biomedical Lab.
STUDY OF AN INORGANIC SYSTEM FOR THE RECOVERY OF OXYGEN (30-DAY EVALUATION PROGRAM) Technical Documentary Report, Jan.–May 1963
Ronald S. Huey Jul. 1964 58 p refs
(AMRL-TDR-64-30; AD-606665) OTS: $1.50

An inorganic system for the recovery of oxygen was investigated during a 30-day evaluation program. This recovered oxygen was used to provide the metabolic needs of a 3-man crew. The total system was based in sequence on 3 techniques: (1) CO_2 removal utilizing regenerable absorbers; (2) Sabatier technique for the production of water; and (3) the electrolysis of water. Techniques for the chemical analysis of gaseous constituents and the adequacy of crew accommodations and equipment under the conditions imposed by confinement were also studied. Gas chromatography proved to be the most suitable analytical technique for detecting unconcentrated trace quantities. Compounds unique to this evaluation program are given. Author

N64-32662 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPONENTIAL MODEL OF BIOLOGICAL EXCRETION OF A RADIOISOTOPE AND ITS UTILIZATION WHEN CALCULATING ABSORBED RADIATION DOSAGES
Frantisek Vitex and Zdenek Dienstbier 18 Feb. 1964 9 p refs Transl. into ENGLISH from Jaderna Energie (Czechoslovakia), no. 11, 1960 p 383–385
(FTD-TT-63-923/1+2; AD-435640)

When determining absorbed dosages of radiation of an incorporated isotope, a new model was introduced, which meets the physiological conditions better than the Stewart model used at present. The new model was experimentally examined with the aid of P-32. Author

N64-32663 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPARATUS FOR DELIVERY OF PURE OXYGEN AND THE MEASUREMENT OF ITS CONSUMPTION IN CHRONIC EXPERIMENTS WITH SMALL ANIMALS
I. S. Breslav 24 Mar. 1964 10 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 49, no. 9, 1963 p 1116–1120
(FTD-TT-63-1118/1+2+4; AD-436013)

Development of an apparatus to study the gas exchange of animals through the uninterrupted delivery of oxygen into the closed system, as well as the exact measurement of its consumption was carried out with simultaneous generation of pure oxygen by a chemical reagent. E.C.

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems.

N64-31422 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FORCE CONDITIONS DURING PRESSING OF PIPES WITH ARBITRARY INTERNAL RELIEF
M. F. Zakharov, Yu. P. Glebov, and M. Z. Yermanok *In its* Nonferrous Met. 30 Jun. 1964 p 180–191 refs (See N64-31404 23-07)

Questions are considered for the analytic determinations of magnitudes β_d and β_{rib} and the establishment, on this basis, of the magnitude of deformation occurring during the pressing out of strips, which is necessary for the production of stress sufficient to provide arbitrary internal relief. A.W.

N64-31423 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPEARANCE OF LINES OF FLUIDITY DURING DEFORMATION OF HIGHLY DURABLE ALUMINUM ALLOYS
A. T. Zakharov *In its* Nonferrous Met. 30 Jun. 1964 p 192–200 refs (See N64-31404 23-07)

It has been found that lines of fluidity appear only in highly durable deformed aluminum alloys, able to take heat treatment. Highly durable aluminum alloys, revealing lines of fluidity, have on the curve diagram of elongation seven independent sections and two zones, revealing lines of fluidity. Both zones are marked by sawtooth changes in the curve, indicating a change of load; every load variation corresponds to the appearance of a new line of fluidity, evokes intermittent plastic flow, and produces sound. Author

N64-31424 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COPPER PLATING FROM PYROPHOSPHATE ELECTROLYTES
V. I. Lainer and V. A. Bardina *In its* Nonferrous Met. 30 Jun. 1964 p 201–210 refs (See N64-31404 23-07)

According to basic indications pyrophosphate copper electrolytes are not inferior to those of copper cyanogen. Cathode polarization in pyrophosphate copper electrolyte is somewhat lower than in cyanogen. Yield of metal along current on anode and cathode is close to theoretical. Uniformity of distribution of metal in pyrophosphate copper electrolyte is approximately the same as in cyanogen. Author

N64-31425 Air Force Systems Command, Wright-Patterson AFB, Ohio
ON THE PROBLEM OF MATHEMATICAL MODEL OF ZONE OF ACTIVE HEAT EXCHANGE OF SHAFT FURNACE FOR PURPOSE OF AUTOMATION OF SMELTING OF OXIDIZED NICKEL ORES
A. Ashmov and D. I. Lisovskiy *In its* Nonferrous Met. 30 Jun. 1964 p 211–218 refs (See N64-31404 23-07)

Shown is an approach to the construction of a mathematical model of the active heat exchange zone of a shaft furnace in order to automate the smelting of oxidized nickel ores. The use of computers is discussed. The mathematical description obtained can be used for the analogous processes of heating of loose material in a countercurrent. Author

N64-31442* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EFFECTS OF ALLOYING ON ROOM-TEMPERATURE TENSILE PROPERTIES OF TUNGSTEN-FIBER-REINFORCED-COPPER-ALLOY COMPOSITES
Donald W. Petrasek and John W. Weeton Repr. from Trans. Met. Soc., AIME, v. 230, Aug. 1964 p 977–990 refs (NASA-RP-311)

An investigation was conducted to determine the effect of alloying on the tensile properties and microstructure of tungsten-fiber-reinforced composites. Composites were made of tungsten fibers infiltrated with copper binary alloys that contain elements of varying solubility in tungsten. Room-temperature tensile tests were made on the composites, and a metallographic study of the microstructure of the fiber–metal–matrix interfaces was conducted. It was shown that, as the depth of penetration of some alloying elements into the fiber increased, a decrease in both tensile strength and ductility of the composite results. A notch effect, due to the formation of a brittle alloy zone with the tungsten fiber, was observed and gave rise to greater reductions in tensile properties and ductility behavior than would be predicted by a law-of-mixture relation alone. Author

N64-31476 Bureau of Naval Weapons, Washington, D.C.
PROCEEDINGS OF THE ROTATING AND STATIC PRECISION COMPONENTS SYMPOSIUM
Apr. 1964 498 p refs
(AD-603137) OTS: $9.40

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3. THE SYNCHRO INDICATING RECEIVER AND ITS APPLICATIONS J. H. Batchelor and F. J. Bright (Muirhead and Co.) p 26–31 (See N64-31479 23-17)

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15. A PROTOTYPE MODEL 13-DIGIT SEQUENTIAL SIZE II OPTICAL ENCODER J. W. Brean (Baldwin (D.H.) Co.) p 223–241 refs (See N64-31491 23-15)

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19. SYNCHRO-TO-DIGITAL CONVERTER R. Y. Kakuda (Gen. Precision, Inc.) p 292–302 (See N64-31495 23-09)

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21. MICROELECTRONIC PRECISION ANALOG AMPLIFIERS M. W. Aarons, J. E. Jennings, and R. E. Loveless (United Aircraft Corp.) p 309–344 (See N64-31497 23-09)

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23. DETECTION AND MEASUREMENT OF SMALL MAGNETIC FIELDS A. R. Clawson and H. H. Wieder (Naval Ord. Lab.) p 362–376 refs (See N64-31499 23-15)

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26. ANALOG TO DIGITAL, BRUSHLESS, SHAFT ENCODER DEVELOPMENT PROGRAM R. A. Retta p 444–448 (See N64-31502 23-15)

27. A BRUSHLESS PHASE SHIFTING DEVICE D. Rosenberg (Reeves Instr. Corp.) p 449–456 (See N64-31503 23-09)

28. DIRECT CURRENT TORQUER F. K. Ibrahim (Vernitron Corp.) p 457–465 (See N64-31504 23-17)

29. HIGH ACCURACY (20 SECOND) SINGLE SPEED RESOLVERS AND SYNCHROS D. Rosenberg (Reeves Instr. Corp.) p 466–474 (See N64-31505 23-17)

30. INVESTIGATION OF POTENTIOMETERS FOR NEW SPECIFICATION REQUIREMENTS J. W. Case p 475–483 refs (See N64-31506 23-15)

31. SELECTION OF CORE MATERIAL IN HIGH PERFORMANCE SYNCHRO R. P. Zablan (Vernitron Corp.) p 484–491 (See N64-31507 23-17)

N64-31477 Bendix Corp., Ann Arbor, Mich.
HIGH TEMPERATURE SYNCHROS
W. Victor Fiore *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 9–13 (See N64-31476 23-17) OTS: $9.40

Two general classifications of high-temperature synchros are briefly discussed. The first group is represented by the utilization of organic insulating materials and conventional metals in standard mechanical designs. These types of synchros perform with good life characteristics up to temperatures of 232° C. The second classification for high-temperature synchros is represented by those that utilize inorganic insulting materials with Curie points exceeding that of 59%-nickel iron. These systems can be operated at temperatures ranging up to 500° C. P.V.E.

N64-31478 United Aircraft Corp., Norwalk, Conn. Norden Div.
APPROACHES IN THE DEVELOPMENT OF QUIET SYNCHROS
M. M. Fawzy *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 14–25 refs (See N64-31476 23-17) OTS: $9.40

Work performed in an attempt to reduce the acoustical noise generated by synchros is outlined. A combination of mathematical computations and experimental investigations was used in a study of the problem. It is concluded that a synchro can be built at the present time to meet stringent acoustical requirements by compromising both size and accuracy. The severity of the compromise depends upon the type and initial design of the unit considered. P.V.E.

N64-31479 Muirhead and Co., Ltd., Beckenham (Gt. Brit.)
THE SYNCHRO INDICATING RECEIVER AND ITS APPLICATIONS
J. H. Batchelor and F. J. Bright *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 26–31 (See N64-31476 23-17) OTS: $9.40

The synchro indicating receiver is a low-torque, low-reaction receiver, specifically designed for light pointer indication. The design is such that a number of receivers may be connected in a synchrosystem without appreciably loading the system, and without reacting on the system even if the receivers are jammed. Receiver design, construction, and flux paths are included in the discussion. P.V.E.

N64-31480 Naval Ammunition Depot, Crane, Ind. Precision Servo Components
QUALIFIED PRODUCTS LISTS
Robert N. Cron *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 32–35 (See N64-31476 23-17) OTS: $9.40

Establishment of a Qualified Products List (QPL) for standard items of hardware is described. A QPL is a definite tool for standardization. Any type of component procured from a QPL today will be the same, or equal, component listed in any future time.The cognizant agency of a QPL is charged with the responsibility for maintaining liaison with listed manufacturers for onsite quality assurance as well as the periodic reevaluation of each manufacturer's capabilities. The purpose of the QPL is fewer standard types of components that have greater applications and reliability. P.V.E.

N64-31482 Naval Research Lab., Washington, D.C.
LUBRICATION OF SMALL ROTATING COMPONENTS
V. G. Fitzsimmons *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 50–56 (See N64-31476 23-17) OTS: $9.40

Various problems associated with lubricating miniature precision ball bearings in devices such as gyroscopes, synchros, and servomotors are discussed in general. In particular, the problem areas associated with synchros, including the following, are outlined: (1) the use of silicon lubricants in an apparent effort to meet specification requirements for torque at low and high temperature; the lubrication behavior of silicones promotes wear and unexpected degradation when used to lubricate ferrous metals in sliding contact; (2) the effect of cleanliness on bearing life; and (3) the limiting of the amount of lubricant to a few milligrams to prevent oil migration into electrical contact areas. Such a limitation does not prevent oil from spreading and being lost from the areas needing it. P.V.E.

N64-31484 Minneapolis-Honeywell Regulator Co., Minn. Aero Div.
THE APPLICATION OF GAS BEARING SPIN MOTORS TO MINIATURE GYROS
R. G. Baldwin and S. J. Korzenowski *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 64–92 (See N64-31476 23-17) OTS: $9.40

The application of gas spin bearings to miniature floated rate-integrating gyros is discussed in some detail. Included in the discussion are the following subjects: (1) basic priciples; (2) instrumentation—steady loads and dynamic loads; (3) materials—wear resistance and surface finish; (4) fabrication and assembly; (5) test results—static data and dynamic data; and (6) gyro data–random drift, cool-down stability, run-up stability. It is concluded that the practical application of miniature gas spin bearings to gyroscopes has been demonstrated and documented; random drift characteristics have been improved by an order of magnitude; and mass stabilities have been improved by a factor of three. P.V.E.

N64-31487 Vernitron Corp., Los Angeles, Calif.
BOOSTERLESS RESOLVER CHAINS
Bernabe Nocito and Dominic J. Santogrossi *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 153–158 (See N64-31476 23-17) OTS: $9.40

Boosterless resolvers that can be used in computing chains without the need for isolation and compensation amplifiers permit substantial simplification and improved reliability, as well as greater compactness in critical applications. A transmission-line equation is presented that can be used to compute the transformation ratio and phase shift in boosterless chain resolver chains. With the equations developed, the permissible tolerances for any given error limit may be analyzed by computing the transformation ratio balance as a result of unbalances in each leg of a chain. Computation of transformation ratios and phase-shift correction capacitors at the end of a chain, using the method described, yielded results within 1% of actual measured values. The method is considered to be most useful in the calculation of electrical performances of boosterless resolver chains. P.V.E.

N64-31488 Pullin (R.B) and Co.,Ltd., Brentford (Gt. Brit.)
PREDICTING SERVO MOTOR CHARACTERISTICS BY COMPUTOR
D. E. Hesmondhalgh, C. B. Flindt, and K. L. Driver *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 159–196 refs (See N64-31476 23-17) OTS: $9.40

A general theory is developed for predicting the characteristics of two-phase servomotors in terms of basic physical dimensions and the inherent properties of the materials of construction. It is shown that it is possible to predict the characteristics of a typical small two-phase servomotor on the basis of the expressions presented. In particular, the data required can, generally be obtained directly from production drawings. The cost of computing a design to meet a particular specification (assuming the specification to be realistic) is dependent upon the number of variable parameters and the range of permitted variations. It is indicated that a typical high-speed computer would be capable of performing the calculations at a cost of about $100. P.V.E.

N64-31489 Reeves Instrument Corp., Garden City, N.Y.
OBTAINING DIGITAL SHAFT ANGLE INFORMATION FROM RESOLVERS AND SYNCHROS
Joseph Carlstein *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Compqnents Symp. Apr. 1964 p 197–211 (See N64-31476 23-17) OTS: $9.40

Several of the more common ways of obtaining digital shaft-angle data are briefly reviewed, and a system is developed as a precision conversion system that is capable of being directly connected to conventional analog systems. The system described is completely electronic, utilizing solid-state components throughout. The system is capable of converting resolver or synchro analog data into digital form, or of synthesizing analog or resolver data from digital input information, and in particular, the system converts 1- and 16-speed analog resolver data to 16-bit parallel binary information. P.V.E.

N64-31500 Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
OPTICAL SOLDERING AND MICROELECTRONIC INTERCONNECTIONS
George J. Veth *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 377–398 refs (See N64-31476 23-17) OTS: $9.40

The cordwood packaging of miniature components and semiconductor integrated circuits has favored welding techniques for interconnection realization because of the inherent control available in welding for producing consistently uniform joints. An optical soldering technique is discussed that has an ability to be automated while incorporating the control necessary for uniform-quality solder joints. Also discussed is the efficient realization of high-density systems through soldering. P.V.E.

N64-31504 Vernitron Corp., Los Angeles, Calif.
DIRECT CURRENT TORQUER
Faik K. Ibrahim *in* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 457–465 (See N64-31476 23-17) OTS: $9.40

The application and design of the frameless, shielded-field, permanent-magnet dc torquers as compared with unshielded-field, permanent-magnet dc torquers are described. The measurement of the magnetic field on the external periphery of the stator stack of both types (shielded-field and conventional-type torquers) of the same size indicated flux leakages of 0.5 gauss on the shielded-field type compared to flux leakages of 500 gauss on the conventional type. At a 20-watt power input, the performance curve showed that the torque-to-power input ratio in the shielded field was 1.25, whereas in the conventional type it was 1.1. The results indicate that in minimizing the flux leakages by shielding the field, a considerable gain in efficiency is obtained. The results also indicated a reduction in the ripple torque. P.V.E.

N64-31505 Reeves Instrument Corp., Garden City, N.Y.
HIGH ACCURACY (20 SECOND) SINGLE SPEED RESOLVERS AND SYNCHROS
Don Rosenberg *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 466–474 (See N64-31476 23-17) OTS: $9.40

The development of a family of size 23, two-pole synchros and resolvers with a maximum electrical error of 20 seconds of arc (equivalent to a computing accuracy of 0.01%) is discussed. Applications for which the high-accuracy components are suitable include positional-data transmission, gimbal readouts, trigonometric-coordinate converters, and laboratory standards. P.V.E.

N64-31507 Vernitron Corp., Los Angeles, Calif.
SELECTION OF CORE MATERIAL IN HIGH PERFORMANCE SYNCHRO
Roque P. Zablan *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 484–491 (See N64-31476 23-17) OTS: $9.40

The basic guide lines in the selection of magnetic core materials for high-performance synchros are discussed. Three types of alloys are evaluated (alloys of iron and silicon, alloys of iron and nickel, and alloys of iron and cobalt with vanadium) with respect to their use in torque and signal-transmission-type synchros. P.V.E.

N64-31513 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONFERENCE ON THE MANUFACTURE OF BLADES. PART II: PRODUCTION OF BLADES BY CASTING AND SHAPING
13 Jul. 1964 105 p refs Transl. into ENGLISH from Zpravod. Vyzkumny a Zkusebni Letecky Ustav (Czech.), no. 2(38), 1963 p 65–104
(FTD-TT-64-305/1+2+3+4; AD-603011)

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9. PRECISION-FORGED TURBINE BLADES K. Simik p 77–95 (See N64-31521 23-17)

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N64-31516 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRODUCTION OF TURBINE BLADES BY INVESTMENT CASTING FROM REFRACTORY ALLOYS

Pavel Sefl *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 17–37 (See N64-31513 23-17)

Foundry and metallurgical problems associated with the production of precision investment castings from refractory steels and alloys are discussed. The various steps in preparing for production and the technological sequence of actual production operations are included. It is concluded that the gating system must make it possible for the stream of metal to fill the mold cavities solidly so that air and gases can escape from the mold without passing the streaming metal. Eddying that pulls the oxide film off the cast and entrains it into the casting must be prevented. M.P.G.

N64-31517 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CASTING TURBINE BLADES AND BLADE RIMS BY THE LOST-WAX METHOD

Drahomir Suchomel *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 38–46 (See N64-31513 23-17)

Experience in precision casting of turbine blades by the lost-wax method is reviewed. The types and shapes of cast components and the materials used in producing them are described; a discussion follows of the various methods of pouring precision castings and the precision and shortcomings of each. M.P.G.

N64-31518 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

VACUUM CASTING OF TURBINE BLADES

Milos Vystyd and Drahomir Suchomel *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 47–64 refs (See N64-31513 23-17)

The methods and equipment used for vacuum melting and casting of nickel-based alloys for gas-turbine blades are discussed. The advantages of vacuum processing include minimization of oxide-film formation, degassing of the alloys, and improvement of creep elongation, fatigue limits, uniformity, plasticity, and refractory properties. M.P.G.

N64-31519 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INFLUENCE OF PRODUCTION TECHNIQUE ON PRECISION OF CASTINGS

Vojtech Krumpolc *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 65–71 refs (See N64-31513 23-17)

Since the dimensional stability of the ceramic mold is an important factor in the precision of castings made by the lost-wax process, the properties of molds made of various materials and fabrication processes were compared. The tests show that the highest dimensional stability is achieved in molds made with a filling mixture consisting of quartz sand and quartz flour that are bound with SiO_2. Molds made by the filled-shell and the hot-monocoque shell processes are practically equivalent in stability. M.P.G.

N64-31521 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRECISION-FORGED TURBINE BLADES

Karel Simik *In its* Conf. on the Manuf. of Blades Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 77–95 (See N64-31513 23-17)

The development of precision forging is reviewed. The principles of proper production technique, and the requirements for the starting materials, the blanks, the forging equipment, and the heating furnaces are discussed. Author

N64-31586 Aerojet-General Corp., Sacramento, Calif.

CRITICAL-COMPONENT-CONTROL PROGRAM: GEMINI LAUNCH VEHICLE PROPULSION SYSTEM Technical Operating Report

2 Jun. 1964 104 p *Its* Rept. No. 0788-GCC-1
(Contract AF 04(695)-393)
(AFBM-58-1; AD-448604)

Included in this report are the purposes and methods of implementation of controls proposed for 97 critical Gemini components. Also contained are engine test directive (ETD) controls, product inspection instructions (PII's), handling instructions, and a project directive. The additional controls for certain critical components of the Gemini system are necessary to insure a quality level compatible with those requirements of a vehicle designated for manned flight. Author

N64-31587 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant

RELIABILITY PROGRAM PLAN FOR THE GEMINI PROPULSION SYSTEM

22 Nov. 1963 53 p
(Contract AF 04(695)-393)
(Rept.-0788-PP-1-R; Supersedes Rept.-0627-PP-1-R; AD-445054)

Described are the organization and procedures to be used in assuring the reliability of the Gemini first- and second-stage liquid rocket engines. The tasks involved are these: (1) a review of design, process, and procedure changes to analyze the effect on the Gemini mission; (2) a reliability improvement program consisting of system-safety-analysis review of all Titan II corrective action for adequacy and of problem studies to determine

proper corrective action; (3) failure reporting, failure analysis, and corrective action feedback; (4) reliability-measurement methods to evaluate Gemini engine reliability and provide a management tool for response to any problems revealed by these evaluations; and (5) preparation and submittal of a monthly reliability summary report. R.L.K.

N64-31591 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
QUALITY CONTROL MANUAL, INSPECTION PROCEDURES FOR SILICON NPN GROWN JUNCTION, DEVICE TYPE 2N333
15 Aug. 1963 252 p
(Contract DA-36-039-SC-86730)
(MPQRA-103; AD-447806)

Covered are the following: organization, general inspection and quality-control practice, product-acceptance testing, test-equipment control, gage control, drawing and specification control, incoming-material control, packaging, packing and marking, returned material, data analysis, reliability engineering, facilities, exhibits, and specifications. R.L.K.

N64-31594 Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM Quarterly Progress Report, 1 Apr.–30 Jun. 1964
15 Aug. 1964 84 p refs
(Contract AT(10-1)-880)
(IDO-28632) OTS: $2.00

After pre-startup modification and checkout were completed, the ML-1 was taken to full power and operated above self-sustaining conditions for 664.5 hr, after which the plant was shut down for maintenance and inspection. The powerplant performance deviated significantly from predictions in two areas—Net work of the turbine-compressor (t-c) set was lower than anticipated, and readout of the temperature of one instrumented fuel element was higher than anticipated. Disassembly and inspection of the t-c set revealed that a spacer had slipped in the turbine, shearing the first stage turbine blades. Inspection of the instrumented fuel element revealed no cause for the above-prediction temperature reading. The fuel element was replaced in the core, and an additional instrumented fuel element was substituted for an uninstrumented fuel element in an adjacent core position. Author

N64-31599 Martin Co., Orlando, Fla.
GLV-2 INTERSTAGE CORDAGE Evaluation Test Report
W. A. Sennello [1964] 30 p
(Contract AF 04(695)-394)
(LV-346; AD-448611)

The rejected wire was fabricated into a test cable and was successfully subjected to propellant compatibility, humidity, vibration, and altitude tests, which are described. The wires met all prescribed functional requirements prior to, during, and following the environmental exposures and revealed no damage that would preclude them from performing their functions. On the basis of having satisfactorily completed the prescribed tests, it is concluded that the damaged wire will not adversely affect the performance of GLV-1 or 2. Author

N64-31622 Springfield Armory, Mass.
TECHNIQUE OF MEASURING LOW PERCENTAGES OF RETAINED AUSTENITE WITH THE USE OF FILTERED X-RADIATION AND AN X-RAY DIFFRACTOMETER
H. R. Erard 2 Jan. 1963 20 p
(SA-TR-2408; AD-422235)

An investigation was made to develop a more accurate technique for measurement of low percentages of retained austenite. Greater accuracy was secured by measurement of integrated intensities of selected martensitic and austenitic diffraction lines within a known probable error. This operation was performed automatically by step-scanning diffraction lines with the use of a counting-rate computer. Retained austenite behavior in carburized 9310 steel was successfully studied by this technique of applying the X-ray method extends the range of measuring retained austenite to comparatively low percentages without requiring the use of a crystal monochromator. The measurement of retained austenite can be performed on the surface of the specimen. The same area can be given subsequent treatments and then be reevaluated. The technique is described, and an application is discussed. Author

N64-31724* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
PROCESSING OF BULKHEAD SEGMENTS FOR SATURN V VEHICLES
E. A. Hasemeyer, R. B. Williams, and W. J. Travis 22 Apr. 1964 60 p
(NASA-TM-X-53033) OTS: $3.00 fs; $0.50 mf

Fabrication of gore segments for bulkheads of the S-IC, S-II, and S-IVB stages of the Saturn V has presented many technical problems. This report discusses the production of gore segments for these bulkheads, beginning with the aluminum alloy ingot and continuing through final inspection of the individual gore. The usual mechanical processes and heat treatments are presented, as well as the chemical operations, such as chemical milling and surface protection. Of particular emphasis are the primary forming methods—hydraulic bulge, stretch, explosive, and incremental dish forming—and post-forming operations, such as chemical milling and contour correction. Author

N64-31726* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF TECHNIQUE FOR EXPLOSIVE FORMING TORUS TANK SUMP SEGMENTS OF ALUMINUM ALLOY 7039
O. M. Tommie, Jr. and E. R. Coleman 27 Aug. 1964 41 p
(NASA-TM-X-53117) OTS: $2.00 fs; $0.50 mf

This report covers the details of efforts to establish explosive forming parameters for the production of Torus Tank sump segments. A description of the tooling, preform configuration, and developed techniques is included. All explosive tests were conducted at the explosive forming facility in the Manufacturing Engineering Laboratory. Author

N64-31822 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
A NEW METHOD FOR THE NON-DESTRUCTIVE TESTING OF SPOT WELDS
Günter Wilkens 3 Sep. 1964 16 p Transl. into ENGLISH from Mitteilungsbl. Amtliche Materialprüfung Neidersachsen (Germany), no. 2–3, 1962–1963 p 28-31
(RSIC-263; AD-606048)

A new nondestructive testing method, for spotwelding evaluation in the aircraft industry, by ultrasonic radiation penetration is described. Reproducible results are obtained only when uniform conditions of coupling are achieved between precisely arranged ultrasonic heads and the test components. For this purpose, the oscillators were built into the spotwelding electrodes of the welding machine, with the electrode cooling liquid serving as the coupling medium between the

ultrasonic heads and the electrodes. Reproducible ultrasound responses were conducted onto the surface of the test item, thus allowing testing to be accomplished automatically during the welding process, and an early defect to be detected by the changes in received pulses. G.G.

N64-31833 Westinghouse Electric Corp., Philadelphia, Pa.
PRODUCTION ENGINEERING MEASURE TYPE 2N1016B SILICON ALLOY TRANSISTOR Final Report, Covering Period Through 24 Apr. 1963
R. W. France, R. J. Pisarcik, and W. E. Shopsky [1964] 249 p
(Contract DA-36-039-SC-86743)
(AD-603159)

A summary of progress, including drawings and data, is presented for each process improvement investigated for the type 2N1016B silicon-alloy transistor. Process improvements are discussed with respect to each of the following: emitter-bridge redesign; weld-ring redesign; getters; base-material modification; dry-air environment; material preparation (silicon); material preparation (junction alloys); material preparation (gold-plated molybdenum); fusion assembly—improved post-etch spray-rinse technique; hard solder assembly; and surface passivation coatings. Also discussed are production runs, reliability measurements, process specification, and inspection and quality-control manual. P.V.E.

N64-31839 Martin Co., Baltimore, Md. Space Systems Div.
INTERIM PREVALVE (PHASE II) Engineering Evaluation Test Report
C. J. Goebel Mar. 1964 50 p refs
(Contract AF 04(695)-394)
(LV-330; AD-448609)

These prevalves feature an offset-mounted, free-floating butterfly disc that is held closed by a squib-powered release pin. The seal between the propellant tanks and the engine is maintained by an elastomeric seal ring that is molded to the periphery of the aluminum butterfly disc. Interim oxidizer system prevalves for Gemini launch vehicles will utilize Resistazine 112 butterfly seals. A comprehensive N_2O_4 exposure test program has demonstrated these seals to have a minimum useful life of 112 hours or 5 launch window days in the propellant. Failure to remove the prevalves within the usage period will result in internal vapor leakage and because of progressive swelling of the soft seal may prevent the valves from opening upon retraction of the pin. Author

N64-31873 Joint Publications Research Service, Washington, D.C.
APPLICATION OF THE METHOD OF DIFFERENTIAL COMPLEX FOR INVESTIGATION OF FLAT ENGAGEMENTS
Ye. V. Blinnikov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 147–149 ref (See N64-31851 23-15) OTS: $5.00

This work demonstrates that the method of helical differential complexes for investigation of spatial engagements is applicable for investigations of flat engagements, although no helices are involved in it. Author

N64-31875 Joint Publications Research Service, Washington, D.C.
EXAMINATION OF CUTTING PROCESS BY END-CUTTERS OF SMALL DIAMETERS
Huang-Chih-Hsi *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 154–158 (See N64-31851 23-15) OTS: $5.00

This article examines the construction of highly productive end-cutters of small diameter, used in processing details in the manufacture of instruments. Under examination are problems of the rational selection of geometric parameters of the instruments and the methods of obtaining details of a greater fineness. Author

N64-31885 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ABOUT OPTIMUM DROPPING OF LOAD
O. M. Golubentsev and V. D. Novikov 16 Jun. 1964 12 p refs Transl. into ENGLISH from Prikl. Mekhan. (Ukr.), v. 10, no. 1, 1964 p 24–31
(FTD-TT-64-222/1+2; AD-602406)

The problems associated with stopping or reversing large, high speed, heavily loaded industrial machines are examined by considering the transient process in the form of a chain n-mass elastic system and determining the differential equations of motion. Formulas expressing the optimum rate of change, whereby the absolute value of maximum deviation is the smallest, are derived. M.P.G.

N64-31894 General Electric Co., Lynn, Mass. Flight Propulsion Div.
HYDRODYNAMIC COMPRESSIVE FORGING Final Report, 9 Jul. 1962–1 Jul. 1964
Richard M. Cogan Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 80 p refs
(Contract AF 33(657)-8793)
(ML-TDR-64-240; AD-604729)

This is a manufacturing process development for the production of closed die forgings using hydrodynamic compressive forces at room temperatures. Upsetting materials in a cavity first filled with a low-strength matrix increases the amount of plastic deformation obtained prior to fracture. The forces necessary to deform materials in this manner can be predicted from the extrusion force required for operation plus what is necessary to overcome the hydrostatic pressure developed by the resistance of the matrix to flow. The materials worked in this program were a low-alloy carbon steel, AISI-4340; a cast-nickel-base high-temperature alloy, SEL-15; an iron-base face-centered-cubic precipitation-hardening alloy, A-286; an iron-base martensite precipitation-hardening alloy, AM-355; a hexagonal close-pack (anisotropic) alloy, 6Al-4V titanium; and a body-centered-cubic refractory alloy, 0.5Ti molybdenum. Author

N64-31911 Boeing Co., Seattle, Wash.
PROCESS DOCUMENT: FABRICATION OF THE BOEING NOSE CAP, MODEL X-20A
F. N. Breslich [1963] 35 p
(Contract AF 33(657)-7132)
(D2-80608; AD-447816)

Described are the specifications, the manufacturing processes and sequences, and the quality-control requirements. R.L.K.

N64-31923 Sylvania Electric Products, Inc., Williamsville, N.Y.
MINUTEMAN GROUND ELECTRONICS SYSTEM FOR WS-133B
L. Ramsauer et al [1964] 15 p Minutes of DDR held at Amherst Labs., Williamsville, N.Y., 25–26 Jun. 1964
(AD-442231)

Three test sets were presented at the meeting: (1) the interrogator; (2) the transponder; and (3) the test plug. They are presented by slides and drawings and discussed. A.W.

N64-31938 Battelle Memorial Inst., Columbus, Ohio
A STUDY OF THE INFLUENCE OF LUBRICANT ON HIGH-SPEED ROLLING-CONTACT BEARING PERFORMANCE
Jerrold Kannel, J. Clarence Bell, and C. Malcom Allen Wright-Patterson AFB, Ohio, AF Propulsion Lab., Sep. 1964 64 p refs
(Contract AF 33(657)-10494)
(ASD-TDR-61-643, Pt. IV; AD-605845)

Some effects of lubricants on the performance of rolling-contact elements have been studied experimentally and theoretically. Circumferential profiles of the contact region of lubricated rolling-contact disks have been obtained using an X-ray technique for a range of loadings, temperatures, and rolling speed with a polyphenyl ether lubricant. A method has been developed for inferring the lubricant film pressures from the measured deformations, and several profiles have been analyzed to yield pressure patterns. Also, a technique has been developed for measuring film pressures directly using a strip of a Manganin coating on a glass disk; this disk is loaded into lubricated rolling contact with a second glass disk. The change in electrical resistance of the Manganin due to the film pressure is measured. The data recorded by these techniques appear to be fairly reproducible and consistent. Author

N64-31939 Automation Industries, Inc., Boulder, Colo. Research Div.
APPLIED RESEARCH TO ESTABLISH INFRARED DETECTION METHODS FOR NONDESTRUCTIVE ANALYSIS OF METALLIC AND CERAMIC STRUCTURES Technical Documentary Report, Feb. 1963–Jan. 1964
D. R. Maley and S. W. Maley Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1964 157 p
(Contract AF 33(616)-7725)
(ASD-TDR-62-385, Pt. III; AD-605510)

Various material properties or defects in samples have been evaluated by one or both of two basic testing methods, known as the scan heat technique and the heat support technique. Both methods operate on the principle that heat-transfer rates through a material are dependent on the properties of the material and the presence of internal defects. Heat is introduced at the surface of a sample. Its transfer away from the surface into the sample is gaged by continuous monitoring of surface temperature with an infrared radiometer. The scan heat technique utilizes a moving spot heat source, while the heat support technique relies on large area heating. Material parameters studied have included voids and unbonds, adhesion of plating, cracks in coatings, bulk and surface deformation, grain size, and analysis of alloys. Author

N64-31941 ALCOR, Inc., San Antonio, Tex.
DEVELOPMENT OF HIGH TEMPERATURE DEPOSITION RIG FOR ADVANCED ENGINE LUBRICANTS Technical Documentary Report, Mar. 1–Nov. 30, 1963
H. G. Buschfort and A. Hundere Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., 23 Jun. 1964 39 p
(Contract AF 33(657)-10037)
(APL-TDR-64-49; AD-606394)

The objective of this program was to develop a test rig and a procedure to evaluate experimental gas turbine lubricants at surface temperatures up to 1000° F and to yield results that are indicative of lubricant performance in advanced high Mach gas turbine engines with respect to sludge, coke, acidity, and viscosity change. The phase of the program covered by this report was directed to studying the effect of variables on a polyphenyl ether, utilizing a 48-hour test. Major emphasis was placed on the formation of deposits. Tests were also conducted on engine-tested oils to further check the correlation previously established. Author

N64-31953 American Machine and Foundry Co., Stamford, Conn. General Engineering Div.
LOGISTICAL OVER-THE-SHORE (LOTS) SYSTEMS STUDY
P. Silverman, G. Bott, J. George, and H. Bossung Ft. Eustis, Va., Army Transportation Res. Command, Jun. 1964 124 p refs
(Contract DA – 44-177-AMC-23(T))
(TRECOM-TR-64-26; AD-605796)

Data related to LOTS have been compiled, and decision rules for varying data in response to varying operating conditions are established. A rationale for computer simulation to test for potential improvements in LOTS productivity is developed. In addition, a method of measuring effectiveness of improvement candidates is derived. Author

N64-31954 Boeing Co., Morton, Pa. Vertol Div.
INVESTIGATION OF THE CONFORMAL GEAR FOR HELICOPTER POWER TRANSMISSION
J. Mack Ft. Eustis, Va., Army Transportation Res. Command, Jun. 1964 150 p refs
(Contract DA – 44-177-AMC-101(T))
(TRECOM-TR-64-28; AD-605844)

The work includes the following: (1) an analytical investigation of the conformal tooth bending and contact stresses; and (2) a design investigation, using the analytical method to illustrate the advantages and problems of the conformal tooth transmission for various ratios and horsepower inputs. Some results of an independent photoelastic stress investigation are also included. Author

N64-31969 North Carolina State Coll., Raleigh
RAW MATERIALS FOR REFRACTORY OXIDE CERAMICS Technical Documentary Report, Oct. 1962–Jan. 1964
Hayne Palmour, III, Jerry M. Waller, R. Douglas Mc Brayer, Dong M. Choi, and Lawrence D. Barnes Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 429 p refs
(Contracts AF 33(616)-7288; AF 33(657)-8741)
(ML-TDR-64-110; AD-605804)

This publication contains data relating to the availability and consumption of raw materials for refractory oxide ceramics. More than 40 separate oxide systems are considered, wherein each of the parent elements can yield at least one oxide (of whatever valence state) having a melting point of 1700° C or above. Of principal interest is the detailed description of 410 individual raw materials and their significant chemical, physical, and particulate properties; they include 39 oxide systems, and are commercially available from 67 different supplier organizations. Author

N64-31977 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEMS OF AUTOMATING MACHINE ASSEMBLY
I. I. Kapustin 27 Aug. 1964 22 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostro. (Moscow), no. 12, 1961 p 64–75
(FTD-MT-64-229; AD-604756)

The two main problems associated with automating the assembly of machines are considered to be the development of automatic equipment capable of the various assembly processes and the production of reliable products. Quality control at the component level together with a reduction in the number of contacts or linkages between components will result in an increase in reliability of the total system. Various automation and reliability theories are reviewed, and a list of recommendations to promote machine-assembly automation is presented. M.P.G.

N64-32096 Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING PROCESS AND EQUIPMENT FOR CONSTRUCTION OF ELECTRON-TUBE MOUNTS Fourth Quarterly Progress Report, Apr. 1–Jun. 30, 1963
N. Rosenberg [1963] 14 p
(Contract DA-36-039-SC-86741)
(AD-425235)

Fine-wire specimens were submitted for shock and vibration testing. Welding of heavy-wire-to-coupon specimens for shock and vibration testing was continued on receipt of additional materials. Author

N64-32097 Midwest Research Inst., Kansas City, Mo.
THE STRUCTURE AND STRENGTH OF EPITAXIAL FILMS Bimonthly Progress Report, 17 Apr.–17 Jun. 1964
Arthur Cunningham, Melvin Lavik, and Paul J. Bryant 17 Jul. 1964 10 p
(Contract NOw-64-0061-d)
(BMPR-4; AD-602490)

The ultra-high-vacuum system, which was constructed during the previous report period, has been modified. Discussions of the initial experiments and modifications made are included. In addition, methods of sample preparation and stress–strain curves obtained from initial experiments are discussed. Author

N64-32118 UXBRIDGE, Cedartown, Ga. Engineering Dept.
DEVELOPMENT OF SHADE STANDARDS AND SHADE TOLERANCES, WOOL/POLYESTER CLOTH, SHADE BLUE 1084, TYPE III Technical Documentary Report, Aug. 1963–Jun. 1964
Wright-Patterson AFB, Ohio, Res. and Technol. Div., Jun. 1964 18 p
(Contract AF 33(657)-12357)
(SEG-TDR-64-41; AD-606120)

Nine different lots of top were dyed, blended, and combed. The same base components were used in all nine lots. Small percentages of colored wool were used to throw the shades to the full red, thin green, etc. These nine different lots were processed into yarn and woven into blankets so that each of the nine lots were used as warp and each of the nine lots were also used as filling. The yarn count and fabric construction of the blankets was standard for fabric of this type. The blanket fabric was finished, submitted to the contractor, and approved. Author

N64-32122 Mechanical Technology, Inc., Latham, N.Y.
RESEARCH ON GAS LUBRICATION AT HIGH TEMPERATURE AND LOW FLOW RATES Fourth Quarterly Progress Report
M. Eusepi, J. Meacher, and P. Lewis 25 Jun. 1964 55 p refs
(Contract AF 33(657)-10694)
(MTI-64TR35; AD-447856)

In the program to develop nitrogen-gas-lubricated journal and thrust bearings with stable operation over a speed range, two bearing concepts were selected for experimental work—the 360° inherently compensated hybrid bearing and the flexure-mounted hybrid pad bearing. The test program and the results of tests completed to date are given for the inherently compensated bearing, and the assembly drawings for the pad bearing are presented. A complete description of the test facility is included. D.S.G.

N64-32126 Joint Publications Research Service, Washington, D.C.
NEW DEVELOPMENTS IN INVESTMENT CASTING TECHNOLOGY
I. A. Pankov, V. A. Skazhennik, and V. A. Shur 5 Oct. 1964 8 p Transl. into ENGLISH from Mashinostr. (Kiev), no. 3, May–Jun. 1964 p 36–38
(JPRS-26697; TT-64-41954) OTS: $1.00

The most promising new development reported in investment casting technology is the method of manufacturing the molds from cold-setting plastics by free filling on a standard mold. Molding cavities are obtained as a mirror image of the standard model with full preservation of its dimensions and configuration. A.W.

N64-32127 Joint Publications Research Service, Washington, D.C.
PNEUMONICS-JET PNEUMOAUTOMATICS
L. A. Zalmanzon 6 Oct. 1964 77 p refs Transl. into ENGLISH from "Pnevmonika-Struynaya Pnevmoavtomatika" Moscow, "Science" Publishing House, 1964 p 1–64
(JPRS-26746; TT-64-51003) OTS: $3.00

This book is a description of a new branch of pneumohydroautomatics and contains the following nine chapters: Chapter 1, "Jet Automatics—A New Branch of Technology"; Chapter 2, "Jet Elements which Perform the Basic Operations of Control and Regulation"; Chapter 3, "Other Jet Automatics Elements Circuits"; Chapter 4, "Penumatic and Hydraulic Printed Circuits"; Chapter 5, "Principles of Construction of Jet Automatic Devices"; Chapter 6, "The Combination of Automation and Hydro-Aerodynamics"; Chapter 7, "The Regions of Applicability of Fluid Jet Control Instruments"; Chapter 8, "Economic Aspects of Industrial Adaptation of Fluid Jet Automation"; and Chapter 9, "Foreign Literature on Fluid Jet Automation.". E.C.

N64-32151 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Materials Processing Dept.
HIGH TEMPERATURE EXTRUSION LUBRICANTS Final Technical Documentary Report, 1 Jul. 1962–15 Jun. 1964
Robert C. Haverstraw Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 155 p refs
(Contract AF 33(657)-9141)
(ML-TDR-64-256; AD-606243)

Numerous experimental lubricant materials were initially evaluated by three laboratory screening tests: (1) A "lubricity" test was devised to measure the lubricating characteristics under conditions simulating those found in extrusion. A total of 265 compounds and mixtures were evaluated by this test. (2) A "reactivity" test determined the relative degree of surface reaction between billet materials and candidate lubricants. Both 4340 steel and molybdenum–0.5% titanium were tested at their respective extrusion temperatures with approximately 50 candidate lubricants each. (3) An "insulation" test measured comparative thermal insulation characteristics for all candidate lubricants that exhibited superior results in the lubricity test. More than 100 extrusion trials each were conducted with 4340 steel and molybdenum–0.5% titanium billets. Objectives of these trials were threefold: establishment of confidence levels for the laboratory tests, secondary screening of the experimental lubricants found to be superior by the laboratory tests, and complete evaluation of the final remaining experimental candidate lubricants. Author

N64-32167 Rock Island Arsenal Lab., Ill.
DEVELOPMENT OF A VEHICLE CORROSION PREVENTIVE—DETROIT AREA FIELD TEST Interim Report
Harry C. Muffley 28 Feb. 1964 31 p
(RIA-64-661; AD-602256) OTS: $0.75

A field test was devised for the evaluation of vehicle corrosion preventives in the Detroit area. Seven compounds were

selected and applied to 21 vehicles by means of an airless spray unit. A procedure for processing vehicles used in the field test was developed. This included inspections during the various stages of processing, cleaning techniques, and the application of the vehicle corrosion preventives. The procedure also indicates when to use prepared data sheets for recording observations made during the different steps of processing. Photographs of specific areas of interest on the vehicles were made, and the location was noted on the data sheet. Author

N64-32170 Space Technology Labs., Inc., Redondo Beach, Calif.
AEROSPACE FLUID COMPONENT DESIGNERS' HANDBOOK, VOLUME I
Glen W. Howell, ed. May 1964 715 p refs
(Contract AF 04(611)-8385)
(RPL-TDR-64-25; AD-447995)

This handbook is a compilation of basic information on the design, analysis, selection, and specification of valves and associated fluid components used in aerospace fluid systems. It is intended to be used as a basic reference for engineers and other technical personnel who are invplved in any phase of aerospace fluid component technology. It contains sections dealing with heat transfer, fluid mechanics, fluid systems, fluid components, modules, analysis, computers, specifications, contamination and cleaning, reliability, materials, and environments. Author

N64-32173 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
WEAPON SYSTEM 107A-2. PRODUCT ENGINEERING PROGRAM: COATED METALLIC THRUST CHAMBERS, EXPANDABLE NOZZLES COMBUSTION INSTABILITY SCALING CONCEPTS, ABLATIVE THRUST CHAMBERS Monthly Progress Report, 1–31 Sep. 1963
15 Oct. 1963 65 p refs
(Contract AF 04(694)-212)
(Rept.-212/SA3-2.2-M-3; AD-421614)

Results are reported from the third test firing of the first coated combustion chamber. Results pertain to film cooling, duration, specific impulse, coating-overlay damage, thermal resistance, burnouts, and bulk rise in the fuel coolant. A design study to improve the 5% film-cooling injector and to minimize the channel erosion is reported, and changes in structure and adjustments are listed. The progress of fabrication of the second and third coated combustion chambers is reported along with projected milestone and completion dates. The results of 16 thermal-shock-specimen tests are given, along with the techniques for preparation and testing of the specimens. Equipment and techniques are being designed for measurement and control of coating thickness. D.E.W.

N64-32188 Goodyear Aerospace Corp., Akron, Ohio
SOLAR REFLECTOR FOAMING TECHNOLOGY Quarterly Progress Report No. 6, 1 Feb.–30 Apr. 1964
May 1964 12 p refs
(Contract AF 33(657)-10165)
(GER-11594; AD-447849)

Accomplishments during the period of this specific progress report are the beginning of fabrication on the 10-foot-diameter mirrors and the delivery of three of these, and the beginning of fabrication of the 2-foot-diameter mirrors and the delivery of one of these. The fixtures required to inflate and test the mirrors in a vacuum chamber included support stand, base plates, contour check fixture with template, and hubs. A.W.

N64-32191 Westinghouse Electric Corp., Baltimore, Md. Molecular Electronics Div.
CONTINUOUS PROCESSES FOR FUNCTIONAL ELECTRONIC BLOCKS Interim Technical Progress Report No. 2, 1 Oct.–31 Dec. 1963
Wright-Patterson AFB, Ohio, ASD, Dec. 1963 65 p
(Contract AF 33(657)-11204)
(ASD-TDR-8-133-2; AD-447954)

This report covers the development program to substantially improve the oxidation, etching, and diffusion processes as they apply to functional electronic blocks and other planar semiconductor devices. Work toward the final goal of an operating line based on the principle of continuous processing has proceeded through model test of basic design features to the design of prototype unmechanized machines. Author

N64-32193 Goodyear Aerospace Corp., Akron, Ohio
SOLAR REFLECTOR FOAMING TECHNOLOGY Quarterly Progress Report No. 4, 1 Aug.–31 Oct. 1963
Nov. 1963 29 p refs
(Contract AF 33(657)-10165)
(GER-11333; AD-447955)

The topics in this paper cover the foam rigidization of two 2-foot-diameter mirrors in an arc tunnel vacuum chamber, using the support fixture, contour measuring device, and other auxiliary equipment of the RTD facility; and the completion of physical-property tests for the 2 lb/ft^3 and 3 lb/ft^3 density foam, and design of the baseplate and support stand for the 10-foot-diameter mirror rigidization. In the evaluation of several high-density foams, creep temperature tests were run, and eliminations were made. G.G.

N64-32200 IIT Research Inst., Chicago, Ill.
HIGH-TEMPERATURE OXIDATION-PROTECTIVE COATINGS FOR VANADIUM-BASE ALLOYS Bimonthly Report, Jun. 1–Jul. 31, 1964
F. C. Holtz et al 1 Sep. 1964 20 p
(Contract NOw-64-0140-C)
(IITRI-B6019-5; AD-605616)

The objective of this program is the development of oxidation-protective coatings for vanadium-base alloys for use at 1800° to 2500° F. The effect of pack-siliconizing on the mechanical properties of 0.020-in.-thick sheet of V-60Cb-1Ti (wt.%) is being studied. Results indicate that the siliconizing process has little effect on strength, but causes some reduction in tensile ductility. However, good ductility is noted at temperatures as low as −320° F. Preliminary results indicate that there is no embrittlement of this coated sheet after 25 4-hr oxidation cycles at temperatures up to 2300° F. The static oxidation life of other vanadium-base alloys, coated by the pack-siliconizing process, is also being investigated. The V-40Cb-30Ta-1Ti has an oxidation life of about 50 hr at 2200° F, and less under cyclic conditions. Author

N64-32203 Great Lakes Research Corp., Elizabethton, Tenn.
PRESSURE BAKED GRAPHITE MATERIALS Technical Documentary Report, Jul. 1963–Jun. 1964
A. R. Novy Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 68 p
(Contract AF 33(657)-11738)
(ML-TDR-64-175; AD-603485)

The objective of the program was to investigate the isostatic pressure baking process as a means for fabricating improved graphites. Using a standard mixture of graphite flour, thermal furnace black, and coal tar pitch, the optimum process conditions within the capability of the apparatus used were determined. Graphite density of 1.91 g/cc, flexural strength

of 3000 psi, and compressive strength of 9000 psi were obtained. Other aggregates and binders were screened, using the above optimum process conditions. An isotropic carbon aggregate, with thermal furnace black and coal tar pitch, resulted in a graphite having a density of 1.95 g/cc, flexural strength of 6400 psi, and compressive strength of 14 000 psi. Graphite properties were essentially isotropic. Author

N64-32213 Ohio State U. Research Foundation, Columbus Antenna Lab.
PROCEEDINGS OF THE OSU-RTD SYMPOSIUM ON ELECTROMAGNETIC WINDOWS, 2-4 JUNE 1964, VOLUME III. SESSION V: FABRICATION AND TESTING OF AIRBORNE RADOMES. SESSION VI: HYPERSONIC ENVIRONMENT
J. F. Guarini [1964] 224 p refs
(AD-605391)

Reports presented at Session V "Fabrication and Testing of Airborne Radomes," and at Session VI "Hypersonic Equipment" are given. Session-V reports include: (1) rain-erosion sled tests; (2) a method of determining the dielectric constant applicable to high temperatures; (3) ceramic-sandwich radome design; (4) slip-casting large fused silica radomes; (5) materials for ceramic radomes, utilizing mosaic techniques; and (6) the design and testing of a large, streamlined, dual-frequency airborne radar. Session-VI reports include: (1) design and construction techniques for radomes for superorbital missions; (2) fused silica for reentry radomes; and (3) dielectric material for hypersonic reentry applications. M.P.G.

N64-32245 United Aircraft Corp., East Hartford, Conn. Research Labs.
LAMINARIZATION OF NOZZLE WALL BOUNDARY LAYERS AS A MEANS OF REDUCING HEAT FLUX Monthly Progress Report, 1 Jun.–30 Jun. 1964
R. L. O'Brien 13 Jul. 1964 6 p
(Contract AF 04(611)-9576)
(C910100-10)

The necessity of providing a good thermal sink for the heat-transfer elements and of maintaining a leak-tight construction in the liquid nitrogen flow passages of the heat exchanger assembly prompted the decision to use a welded aluminum construction. Commercially pure aluminum was selected because of its excellent welding characteristics, its good machining characteristics, and the low thermal distortion encountered in weldments of pure aluminum. The welds were made by the inert gas shielded arc technique (heli-arc). The inner pieces containing the nitrogen flow passages were first welded together, and then two plates were welded over the sides of this assembly. This latter welding process opened up a small leak in the inner assembly that did not become apparent until after the final machining pass. This problem was solved by removing the welded side plates, sealing the inner welds again, and fabricating new side plates that were then bolted to the inner assembly. Author

N64-32251 Rock Island Arsenal Lab., Ill.
LIQUID SCINTILLATION COUNTING APPLIED TO RADIOMETRIC TOOL WEAR TESTING
W. Dennis Mc Henry 4 Mar. 1964 27 p refs
(RIA-64-729; AD-602717) OTS: $0.75

Liquid scintillation techniques are shown to be approximately 20 times more sensitive than solid crystal techniques for the determination of beta activity in metal chips cut with an irradiated tool bit. Relative tool wear can be determined easily by simply immersing the metal chips in a suitable counting solution. Total wear can be determined accurately by extracting the radioactive tracer from the chips and comparing it with the specific activity of the tool bit. Author

N64-32352* Mechanical Technology, Inc., Latham, N.Y.
LUBRICATION ANALYSIS IN TURBULENT REGIME First Quarterly Report
F. K. Orcutt, C. W. Ng, J. H. Vohr, and E. B. Arwas 1 Oct. 1964 87 p refs
(Contract NASw-1021)
(NASA-CR-54195; MTI-64TR57) OTS: $3.00 ph; $0.75 mf

A turbulent-flow lubrication theory for the composite tilting-pad bearing has been developed. Design data calculations have been made, and results are presented. The theoretical static-load capacity, dynamic-load properties, frictional torque, and flow are given for a wide range of conditions covering the practical operating range for a four-pad, 80° pad, arc bearing. Modifications to the dynamic-load-bearing apparatus, including the installation of a torquemeter for measurement of test bearing frictional torque, have been made. Preliminary experiments to determine the parasitic torque characteristics of the apparatus have begun, and initial results are given. The tilting-pad test bearing has been designed and fabrication is underway. Author

N64-32359 Great Lakes Research Corp., Elizabethton, Tenn.
RESEARCH ON PRESSURE BAKED GRAPHITE MATERIALS Quarterly Progress Report, Oct. 1, 1963–Jan. 1, 1964
G. Stecker and R. Hund Jan. 1964 19 p
(Contract AF 33(657)-11738)
(AD-447962)

This report covers the initial experimental work on a research program to investigate an isostatic-pressure baking process as a means of fabricating improved graphite products. Preformed mixtures of carbonaceous flour, thermal black, and coal tar pitch were rapidly baked while subjected to a controlled gas pressure, with a controlled isostatic mechanical pressure superimposed on the specimen. After graphitization, specimens with apparent densities as high as 1.96 g/cc were obtained. Permeabilities less than 0.007 cm^2/sec, flexural strengths greater that 4500 psi, and compressive strengths greater than 13 500 psi were obtained. Studies were made to determine the optimum process variables within the capabilities of the equipment. Process conditions and product properties are presented and discussed. Author

N64-32360 Boeing Co., Seattle, Wash. Aero-Space Div.
INVESTIGATION OF SELF-ALIGNING BEARING MOUNTINGS FOR SPACE OPERATION Quarterly Progress Report, Mar. 1–Jun. 1, 1963
C. R. Adams, J. L. Ballinger, M. E. Campbell, R. G. Roesner, F. Schenk et al Jun. 1963 54 p refs
(Contract AF 33(657)-10422)
(QPR-1; AD-447964)

Eleven self-aligning mounting concepts plus sixteen variations in selected concept designs were evaluated. Two concepts, an antifriction gimbal mounting and a multiple-lubricant ring design are recommended for fabrication and test. A lubricant study conducted indicated that low sliding friction coefficients may be obtained throughout a −100° to 2500° F temperature range by incorporating two different lubricants in a single concept. Test equipment was designed, and fabrication has been initiated to evaluate self-aligning mountings from −100° to 2500° F in air and from −100° to 1500° F in a 1×10^{-9} torr vacuum. Author

N64-32374 Union Carbide Corp., Parma, Ohio Linde Div.
DEVELOPMENT OF THIN ORGANIC ROLLED FILM CAPACITOR Quarterly Progress Report, Apr. 1–Jun. 30, 1964

D. J. Valley [1964] 39 p
(Contract NObsr-89519)
(QPR-4; AD-604410)

Fabrication techniques and process improvements were studied in the development of a capacitor using ML-1 film that meets military-specification performance characteristics, but is twenty times smaller than the conventional capacitor. Aspects discussed include substrate preparation, coated foils, slitting, metallized materials, mechanical or thermal damage during processing, and stability and reliability of product capacitors. D.S.G.

N64-32411 Howard Research Corp., Arlington, Va.
STANDARDIZATION ENGINEERING PRACTICES STUDY OF ELECTRONIC COMPONENT PARTS Final Report, 1 Jul. 1962–20 Feb. 1964
A. Arnold Lawson et al 15 Jun. 1964 151 p
(Contract DA-36-039-SC-90906)
(AD-602047) OTS: $5.00

Manufacturers were surveyed to determine the availability of components having weldable leads. Body styles and lead materials to be tested were selected. Resistors, capacitors, and inductors were subjected to applicable tests that might yield evidence of degradation due to the addition of weldable leads. Conclusions include the statement that, because of the poorer quality of the mechanical attachment of a weldable lead over a copper lead, reduction in mechanical performance is encountered. Recommended military standards for weldable leads are referred to, and a recommendation is presented that serious consideration should be given the alternate possibility of welding a copper lead, which is within the state-of-the-art. D.E.W.

N64-32418 Bureau of Mines, Rolla, Mo. Rolla Metallurgy Research Center
VAPOR DEPOSITION OF TUNGSTEN ON MERM ROCKET NOZZLES
Frederick W. Hoertel 1964 24 p refs
(BM-RI-6464; AD-448774)

Tungsten from the hydrogen reduction of WF_6 was vapor-deposited to coat MERM (Material Evaluation Rocket Motor) graphite and rhenium-lined graphite nozzles. These nozzles have surface configurations that preclude the conventional fabrication of high-density-tungsten liners. Operation at 550° C produced selectively placed uniform coatings of specified thicknesses at near theoretical density. An acceptable coating could not be deposited on a beryllia nozzle because of an undesirable side reaction between the substrate and one or more of the products of the reduction reaction. Author

N64-32424 Space-General Corp., El Monte, Calif.
DESIGN DEVELOPMENT AND ENVIRONMENTAL STRUCTURAL TESTING OF RE-ENTRY PARAGLIDER COMPONENTS Second Monthly Progress Letter, 15 Feb.–15 Mar. 1963
J. E. Keville 18 Mar. 1963 18 p
(Contract AF 33(657)-10252)
(SGC-335-2; AD-442725)

Aerodynamic and thermodynamic studies of suitable construction materials for reentry paraglider components are continuing. The materials and process efforts have resulted in an accumulation of performance, mechanical, and thermal-property data on candidate matrix and reinforcing materials, in addition to cost and availability information. A program for air-arc plasma-jet and oxygen-acetylene torch evaluation of the best candidate matrix materials is outlined. A number of elastomeric silicone specimens have been formulated for these tests, including samples with additives to increase temperature resistance or improve ablation characteristics. M.P.G.

N64-32444 Rock Island Arsenal Lab., Ill.
CORRELATION OF AN ACCELERATED CONDENSATION APPARATUS WITH THE JAN–H–792 HUMIDITY CABINET
Van Y. S. Hong and David Bootzin 22 Jun. 1964 24 p refs
(Rept.-64-2039; AD-605598) OTS: $0.75

Included in this study is the employment of a test specimen which was found to be applicable to both apparatus. This test specimen interchangeability was confirmed by the results obtained relative to condensation rate, temperature differential, and performance tests under controlled conditions. Comparative data on six rust preventives were obtained in the two apparatus. A statistical analysis of results indicated that the Accelerated Condensation Apparatus is an improvement over the JAN-H-792 Humidity Cabinet with respect to test time and precision. Short test time is obtained by increased condensation on the test specimen, and good precision is obtained by overall control of the test conditions. Author

N64-32461 Naval Applied Science Lab., Brooklyn, N.Y. Material Sciences Div.
REPORT OF INSPECTION OF NEOPRENE COATINGS APPLIED TO HYDROFOIL ASSEMBLIES OF HYDROFOIL CRAFT, HIGH POINT (PC(H)-1
18 Sep. 1963 9 p refs
(TM-1; AD-449238)

Examination of the ML-C-570 neoprene coating applied to the foils, struts, rudders, and flaps of the PC(H)-1 after preliminary trials indicate the following: Approximately 5% of the coating separated from the steel due to inadequate adhesion, and about 5% of the top ply peeled from the coating. Work has been initiated to develop an epoxy adhesive system to improve the bond of the coating to the HY-80 steel. The coating showed evidence of barnacle fouling, most of which had sloughed off during the trials. Modification of the ML-C570 coating system to incorporate anti-fouling capability has been initiated. Author

N64-32511 Aeronutronic, Newport Beach, Calif.
APPLICATION OF MATERIALS TO ADVANCED ROCKET NOZZLE AND HOT GAS CONTROL SYSTEMS Third Quarterly Progress Report
H. M. Blaes, R. M. Hale, J. K. Hall, R. L. Johnson, A. M. Saul et al 15 Apr. 1964 78 p
(Contract AF 33(657)-11217)
(U-2577; AD-449225)

Laboratory experiments to determine the recession rates of candidate nozzle materials using high-pressure, high-temperature, convective flow experiments have been conducted. The oxidation characteristics of a zirconium boride–graphite-silicon composite as well as a zirconia-fiber-reinforced composite were examined at total pressures typical of chamber pressures. Arc jet bench tests have been conducted on a variety of reinforced plastic ablative materials. An analysis of the shear strength test of ablative materials is presented. A coated metal expansion cone test has been designed. The configuration is shown and discussed. The experimental heat transfer in the chamber and nozzle throat of a fluorine–hydrazine rocket motor is presented. Author

N64-32542 Westinghouse Electric Corp., Philadelphia, Pa.
PRODUCTION ENGINEERING MEASURE: DIODE, SILICON POWER, CONTROLLED RECTIFIERS SCL700413, SCL-700414, SCL700415 Final Report, 1 Jul. 1960–24 Dec. 1963
T. C. New, W. J. Bilo, W. P. Kauffman, T. P. Nowalk, H. E. Farree et al [1963] 324 p
(Contract DA-36-039-SC-85944)
(AD-448624)

Data on design, drawings, process specifications, test equipment, pilot production layout, and quality control provisions are presented. The results of the pilot production devices provided indicate that all Lot Acceptance Tests were successful. Author

N64-32568 Naval Weapons Evaluation Facility, Albuquerque, N. Mex.
A METHOD FOR OBTAINING NONPARAMETRIC CONFIDENCE INTERVALS IN UP-AND-DOWN TESTING
Patrick L. Odell and Wallace E. Franck, Jr. 1 Mar. 1963 29 p refs
(NAVWEPS-7988; AD-298288)

A procedure is given for obtaining an interval estimate of the solution of the regression equation $M(x) = 1/2$. Knowledge of the form of $M(x)$ is not required. Author

N64-32580 Westinghouse Electric Corp., Dayton, Ohio
GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM Interim Technical Documentary Progress Report No. 6, 25 Jun.–24 Sep. 1963
[1963] 13 p
(Contract AF 33(657)-8162)
(AD-422273)

The primary effort was centered around the preparation of gallium arsenide web dendrites. All furnaces were in operation. Improvements were made in certain critical furnace designs. The results of these design changes aided in the preparation of very narrow web. In addition, 20 in. of dendrite were prepared in one single run. Author

N64-32616 Battelle Memorial Inst., Columbus, Ohio
DESIGN, PERFORMANCE, FABRICATION, AND MATERIAL CONSIDERATIONS FOR HIGH-PRESSURE VESSELS
E. J. Mills, T. J. Atterbury, L. M. Cassidy, R. J. Eiber, A. R. Duffy et al Huntsville, Ala., Army Missile Command, 30 Mar. 1964 237 p refs
(Contract DA-01-021-AMC-203(Z))
(RSIC-173; AD-603694)

Bottles and tanks for high pressures of 5000 lb/in.^{2} and above are discussed under the classifications of design, performance, fabrication, and material considerations. Single-walled, multilayered, and banded pressure vessels are considered together with manufacturing methods. Test procedures and fracture initiation and propagation are discussed and analyzed. Consideration is also given to materials and specifications. Author

N64-32618 International Resistance Co., Philadelphia, Pa.
PRECISION VOLUME RESISTOR Interim Development Report, 1 Jun.–31 Aug. 1964
C. Huang and Kenneth M. Merz 20 Sep. 1964 29 p
(Contract NObsr-89439)
(IDR-5; AD-606707)

Resistors based on palladium or palladium–silver dispersed in a ceramic matrix were fabricated, and their ranges and temperature coefficients were measured. Pre-mil screening tests were completed. Termination methods for the solid slugs were investigated. A modified electroless Cu-plating process was found acceptable and gave pull strengths of ~15 lbs. The fact that bismuth trioxide additions to the palladium–ceramic system shifts temperature coefficient toward negative values was established. Author

N64-32642* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELECTED WELDING TECHNIQUES, PART II Technology Utilization Notes
Washington, NASA, Jul. 1964 39 p
(NASA-SP-5009) GPO: $0.30

New methods utilizing butt joints in welding aluminum plate are described. Special weld-joint configurations were designed for large aluminum tank segments having varying material thickness. A metal-edge-upset process was developed for aluminum-alloy cylindrical sections, as a result, material thickness can be based on stress requirements only, and machining operations to effect weld-joint fitup and groove configuration are eliminated. A non-freewheeling thyratron-type motor governor was developed to provide control in motor-speed shifts for automatic-fusion welding equipment and other applications. Investigations to determine the effects of external magnetic forces acting upon a dc welding arc indicated that no fields of any appreciable magnitude can be tolerated near the welding arc; even 20 Gauss can cause lack of penetration. Also described are the TIG process, electron-beam welding, improvements in aluminum-weld filler wire, a welding nozzle to eliminate fumes and vapors without adversely affecting the shielding gas atmosphere around the welding arc, the use of fiber optics to permit close observation of vacuum chamber work in electron-beam welding, and an economy automation system for the welding of space vehicles. R.L.K.

N64-32651 Battelle Memorial Inst., Columbus, Ohio
DEVELOPMENT OF A LONG-LIFE CONTACT SEAL FOR A HIGH-SPEED ROTATING SHAFT IN LIQUID-METAL DYNAMIC POWER SYSTEMS Quarterly Progress Report, 1 Apr.–1 Jul. 1964
S. J. Basham, C. M. Allen, and W. A. Glaeser 15 Jul. 1964 39 p
(Contract AF 33(657)-10961)
(AD-449609)

Development of materials, for rubbing-contact seals, which will form interfacial lubricating films in contact with potassium, has continued with emphasis on three promising materials, Al_2O_3, Y_2O_3, and ZrO_2, used in DTA (differential thermal analysis) and 1000-hr compatibility experiments. Experiments with Al_2O_3 indicate that this material possesses the desired properties, although the extent of the reaction appears to be dependent on the density of this metal oxide and the quantity and type of the trace impurities in the material. Experiments in the friction and wear apparatus have included runs with a Cr-Al_2O_3 material and two runs with Al_2O_3. There was a marked decrease in friction coefficient during the runs in potassium vapor in one experiment with Al_2O_3 and the experiment with the Cr-Al_2O_3 material. The other Al_2O_3 experiment showed very low friction in vacuum and potassium, behavior not noted in any other experiment. The surface film was somewhat different from that on the other Al_2O_3 specimens and is being further examined. Author

N64-32655 Standard Pressed Steel Co., Jenkintown, Pa.
STRUCTURAL FASTENING TECHNOLOGY Progress Report, Mar.–Jun. 1964
T. A. Roach, Jr., T. Greene, and M. H. Ortner (Vitro Labs.) 15 Jul. 1964 57 p
(Contract AF 33(657)-11684)
(PR-3; AD-449756)

The dynamic oxidation testing portion of the thread form requirement study was completed. Development of the electrophoretic adaptation of the Cr-Ti-Si coating for columbium alloys was completed satisfactorily. The balance of the columbium alloy threaded fasteners were manufactured and prepared for coating. Coating comparison testing was completed with the selection of the electrophoretic Cr-Ti-Si coating for the columbium alloy fasteners, and coating of the Cb 752 threaded fasteners was started. Investigation of deformability of coated columbium alloys was continued with oxidation tests on deformed sheet specimens. Author

N64-32661 SKF Industries, Inc., Philadelphia, Pa.
STATE-OF-THE-ART APPRAISAL USAF-SwRI AEROSPACE BEARING CONFERENCE, SAN ANTONIO, TEXAS, MARCH 25–27, 1964
Frank W. Wellons [1964] 23 p
(AD-449772)

Discussed is work carried out in studying the mutual dependence of lubrication and construction on bearing life in the space environment. Bearings made of air- and vacuum-melt steel are compared. Also discussed are the contribution of improved materials to bearing reliability and methods of endurance testing bearings. P.V.E.

N64-32677 Lodge and Shipley Co., Cincinnati, Ohio
FABRICATION OF AN HK31A MAGNESIUM ALLOY AIRFRAME SKIN
J. A. Warnken and W. H. Busch Jun. 1963 128 p
(Contract DA-33-008-ORD-2084)
(AD-442883)

A fabrication procedure combining template-controlled power spinning and Floturning would make it possible to start with a flat blank thereby eliminating the problems encountered with heated press dies. The various operation configurations and thicknesses are calculated using standard Floturn methods combined with new methods of calculating material displacement so as to provide uniform ratios of reduction. Two test lots of material were processed through the first three of four operations. After the first lot, the blank thickness was increased and the thickness of all operations recalculated to compensate for overthinning encountered due to material ductility. The feasibility of forming contoured airframe skins of HK31A magnesium alloy is proven, provided the temperature of the tooling and workpiece is maintained at 700° F. Author

N64-32687 IIT Research Inst., Chicago, Ill. Technology Center
INVESTIGATION OF FASTENERS AND FASTENING TECHNIQUES Third Quarterly Progress Report, 15 Feb.–15 May 1964
E. H. Koeller [1964] 27 p
(Contract DA-36-039-AMC-02303(E))
(Rept.-3; AD-443797)

The overall objective of the program is to establish the relative performance capability of various fasteners and fastening techniques as used in military electronic equipment. The emphasis is on comparing the relative effectiveness of different types of fasteners with good performance capability, intended for similar service applications. The general classifications of fasteners under investigation include threaded inserts, self-tapping screws, lock nuts, etc. Principal activities were concerned with characterizing the various fasteners under static loading conditions. In addition, time was spent in adapting the basic test fixtures to the requirements of individual types of fasteners to permit their evaluation. Author

N64-32688* General Electric Co., Philadelphia, Pa.
9-1/2 FOOT DIAMETER MASTER AND MIRROR
Washington, NASA, Oct. 1964 209 p refs
(Contract NAS7-100; JPL-950239)
(NASA-CR-103) OTS: $3.50

Only the calorimetric testing of the finished mirror remains to be carried out in a project to produce, from a plastic spincast female mold, a male nickel electroforming from which a nickel electroformed 9 1/2-ft collector was fabricated. Optical data on the finished mirror indicate that the spincasting and electroforming techniques used are applicable to the production of high-accuracy solar concentrators of any size. M.P.G.

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-31420 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INFLUENCE OF PRELIMINARY DEFORMATION ON SELF-DIFFUSION IN SILVER AND ITS ALLOYS
M. E. Yanitskaya *In its* Nonferrous Met. 30 Jun. 1964 p 170–179 refs (See N64-31404 23-07)

Self-diffusion in pure iron, diffusion of tin in nickel and its alloy during imposition of stretching efforts, and preliminary deformation on self-diffusion in silver and its alloys were studied. The coefficient of diffusion during annealing of preliminarily deformed alloys remained constant. A.W.

N64-31421 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF INFLUENCE OF COMPOSITIONS AND TEMPERATURE CONDITIONS ON HOT-BRITTLENESS OF ALLOYS OF ALUMINUM WITH MAGNESIUM DURING CASTING IN CHILL MOLD
Ma Chia-Chi and A. G. Spasskiy *In its* Nonferrous Met. 30 Jun. 1964 p 174–179 refs (See N64-31404 23-07)

The paper reports on an investigation of the influence of temperature during casting in chill mold on the content of magnesium in aluminum alloys. The composition of the alloy was also studied for determination of its influence on hot brittleness. All alloys were prepared from aluminum of brand A0 (99.6%) and aluminum–magnesium alloy containing 20% magnesium from aluminum of brand A0 and magnesium of brand MG-1 (99.92%) A.W.

N64-31455* Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF THE WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS Fourth Quarterly Report, Mar. 21–Jun. 21, 1964
G. G. Lessmann and D. R. Stoner [1964] 32 p ref
(Contract NAS3-2540)
(NASA-CR-54166; WANL-PR-P-004) OTS: $2.00 fs; $0.50 mf

The TIG- and EB-butt-weld parameter optimization studies are reported for some of the alloys being tested for use in advanced alkali–metal space electric-power systems. Based on test results of the first four alloys, the parameter selection for the EB welding was modified for better discrimination between parameter-variation effects on weld-bend transition temperature. The bead-on-plate restraint patch test was made for the W-25 Re alloy; a tendency toward loss of ductibility in the heat-affected zone and weld, and consequent cracking during welding, was demonstrated. The copper clampdown inserts in the TIG sheet butt-welding fixture were replaced with molybdenum to reduce arc edge flashing. A heated ribbon titanium purifier was tested to improve the TIG welding atmosphere. R.L.K.

N64-31467 Joint Publications Research Service, Washington, D.C.
RELATIONSHIPS BETWEEN TEMPERATURE AND DEFORMATION IN METALS

24 Sep. 1964 19 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 2, 1964 p 110–115, 126–130
(JPRS-26543; TT-64-41801) OTS: $1.00

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1. SOURCES OF EXCESS VACANCIES WHICH FORM DURING SINTERING OF METAL POWDERS A. P. Savitskiy, V. I. Itin, V. N. Zhdanova, and Yu. I. Kozlov p 1–8 refs (See N64-31468 23-18)

2. ROLE OF VISCOUS DISLOCATION MOTION IN THE TEMPERATURE-STRAIN RELATIONSHIP OF SUBSTITUTIONAL SOLID SOLUTIONS L. Ye. Popov, L. M. Butkevich, and N. A. Aleksandrov p 9–16 refs (See N64-31469 23-18

N64-31468 Joint Publications Research Service, Washington, D.C.

SOURCES OF EXCESS VACANCIES WHICH FORM DURING SINTERING OF METAL POWDERS

A. P. Savitskiy, V. I. Itin, V. N. Zhdanova, and Yu. I. Kozlov *In its* Relationships between Temp. and Deformation in Metals 24 Sep. 1964 refs (See N64-31467 23-18) OTS: $1.00

The influence of heating rate up to the isothermal holding temperature is investigated for copper-powder briquettes that possess a different initial porosity on the magnitude of final shrinkage. The obtained results are in accordance with the diffusion diagram of sintering. Author

N64-31469 Joint Publications Research Service, Washington, D.C.

ROLE OF VISCOUS DISLOCATION MOTION IN THE TEMPERATURE-STRAIN RELATIONSHIP OF SUBSTITUTIONAL SOLID SOLUTIONS

L. Ye. Popov, L. M. Butkevich, and N. A. Aleksandrov *In its* Relationships between Temp. and Deformation in Metals 24 Sep. 1964 p 9–16 refs (See N64-31467 23-18) OTS: $1.00

Evidence is presented supporting the statement that T_{max} can be considered as the temperature above which deformation provides a completely viscous motion of dislocations. Formulas are derived for finding T_{max}, and results are tabulated for Cu_3Au, β-brass, L62 α-brass, and nichrome with 28.5% Cr. The physical interpretation offered for the observed drop in T_{max} with increased degree of strain is that a given rate of deformation is provided where the smaller the velocity of viscous dislocation motion the greater will be the length of moving dislocations and, subsequently, the higher the dislocation density. The relationship of temperature vs strain is calculated for polycrystalline L62 brass, using a variation of the T_{max} equation, and the results are in satisfactory agreement with experimental values of T_{max} for various degrees of deformation. M.P.G.

N64-31473 Joint Publications Research Service, Washington, D.C.

WELDABILITY OF HEAT-RESISTANT MATERIAL SAP BY METHOD OF FUSION

G. D. Nikiforov and S. N. Zhiznyakov 8 Oct. 1964 14 p refs Transl. into ENGLISH from Svarochnoye Proizvodstvo (Moscow), no. 6, Jun. 1964 p 1–4
(JPRS-26793; TT-64-51050) OTS: $1.00

The causes of the unsatisfactory behavior of SAP during arc welding are outlined; technology developed for the manufacture of SAP capable of being fusion welded and having higher plasticity are discussed. The following are concluded: (1) Weldable SAP can be joined by arc welding by the application of fluxes and by using a medium of protective gases. (2) The strength of welded joints obtained during automatic argon-arc welding of weldable SAP was 81% to 100% of the strength of the basic material; at 500° C it was 96%. (3) Weldable SAP welds well with other aluminum alloys. P.V.E.

N64-31486 Carpenter Steel Co., Reading, Pa.

A 45% NICKEL, 5% CHROMIUM-IRON ALLOY, and a 29% NICKEL, 17% COBALT-IRON ALLOY FOR ROTATING COMPONENTS

W. S. Eberly and P. J. Gibilisco *In* Bur. of Naval Weapons Proc. of the Rotating and Static Precision Components Symp. Apr. 1964 p 136–152 (See N64-31476 23-17) OTS: $9.40

Two alloys that appear to have desirable magnetic and physical properties for use in precision rotating components are discussed. The properties of the two alloys are compared with two commonly used nickel–iron alloys. The two alloys (a 45% nickel, 5% chromium, balance iron alloy; and a 29% nickel, 17% cobalt–iron alloy) are shown to have desirable magnetic and physical characteristics for magnetic cores in rotating components. Due to its high resistivity, the chromium-bearing alloy, as a magnetic core, results in an efficient high-frequency unit. The cobalt-bearing alloy, having a high saturation, lends itself toward high-torque applications. P.V.E.

N64-31514 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

REFRACTORY Ni-Cr-BASED CASTING ALLOYS

Josef Vodsedalek and Milos Vystyd *In its* Conf. on the Manuf. of Blades. Pt. II: Production of Blades by Casting and Shaping 13 Jul. 1964 p 1–12 (See N64-31513 23-17)

This paper presents an account of the development of Ni-Cr alloys having the basic composition 15Cr-70Ni-4Mo-5W hardened by Ti and Al. The work done with experimental melts was designed to verify the extent—i.e., the contents of the hardening elements—to which working by conventional methods would be possible; also, the position of the hardening-admixture optimum and the extent to which the properties of the basic alloy, particularly its refractory properties, can be influenced by other admixtures, such as B, Zr, and Co. Diagrams show the properties of the optimum alloys. Author

N64-31568* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FATIGUE-CRACK PROPAGATION IN SEVERAL TITANIUM AND STAINLESS-STEEL ALLOYS AND ONE SUPER-ALLOY

C. Michael Hudson Washington, NASA, Oct. 1964 32 p refs (NASA-TN-D-2331) OTS: $0.75

Axial-load fatigue-crack-propagation tests were conducted on 8-inch-wide sheet specimens made of Ti-4Al-3Mo-1V

(aged), Ti-6Al-4V (annealed), and Ti-8Al-1Mo-1V (triplex annealed) titanium alloys, AM 350 (20% CRT), AM 350 (double aged), PH 14-8Mo (SRH 950), PH 15-7Mo (TH 1050), and AISI 301 (50% CR) stainless steels, and Rene 41 (Condition B). Tests were run at 80°, 550°, and, in some cases, −109° F to determine the effect of temperature on the fatigue-crack-propagation characteristics of each material. The materials are ranked according to their resistance to fatigue-crack propagation, and Ti-8Al-1Mo-1V (triplex annealed) appeared to be the most resistant over the temperature range of the investigation. Special apparatus developed for the elevated- and cryogenic-temperature studies are described. Author

N64-31593 Battelle Memorial Inst., Columbus, Ohio
EFFECT OF 5 a/o TANTALUM ON THE UC–UC_2 SYSTEM
Walston Chubb and Donald L. Keller 13 Jul. 1964 14 p refs
(Contract W-7405-ENG-92)
(BMI-1673) OTS: $0.50

The structures of a series of castings containing 5 at.% tantalum, 45 to 65 at.% carbon, balance uranium were analyzed in terms of their implications with regard to the nature of the uranium–carbon–tantalum system at the liquidus temperature. The minimum in the liquidus between UC and UC_2 apparently develops into a ternary eutecticlike trough, which passes through a minimum temperature at a composition containing a negligible amount of tantalum, 57 to 59 at.% carbon, balance uranium. This trough proceeds on and passes through a point near 65 at.% carbon, 2 to 3 at.% tantalum, balance uranium. Author

N64-31626 Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
THE HYDROGEN EMBRITTLEMENT SUSCEPTIBILITY OF A HIGH STRENGTH STEEL CONTAINING URANIUM
Edward J. Jankowsky 25 Sep. 1963 9 p
(NAEC-AML-1759; AD-421434)

Two steel samples from the same original melt (similar to AISI 4340 but of slightly lower molybdenum content) were used, but 0.074% to 0.075% uranium was added to the ladle prior to pouring one of the ingots. The results indicated that the behavior of the uranium bearing steel at high stresses was slightly better, but not great enough to warrant its use as a substitute for currently used steels. R.L.K.

N64-31631 Phillips Petroleum Co., Bartlesville, Okla. Research Div.
EFFECT OF JP-5 SULFUR CONTENT ON HOT CORROSION OF SUPERALLOYS IN MARINE ENVIRONMENT Progress Report No. 1
H. T. Quigg [1962] 26 p refs
(Contract NOw-64-0443-d)
(Rept.-3824-64R; AD-603422)

An exploratory program was undertaken to indicate the effect of test variables on the hot corrosion of turbine blade and turbine nozzle guidevane materials. This program included an evaluation of the effect of low (0.0002), and high (0.40 weight percent) fuel sulfur content at six gas temperatures (1200° 1400°, 1600°, 1800°, 2000°, and 2200° F) on metal loss of six superalloys (Udimet 700, Stellite 31, Hastelloy R-235, Haynes Alloy 25, Sierra Metal 200, and Udimet 500) in the presence of 10 ppm "sea salt" in the combustor air. A cascade test-specimen holder was designed and fabricated that permitted simultaneous evaluation of the effect of sulfur on six superalloys. The results obtained showed the following: (1) fuel sulfur inhibited metal loss at gas temperatures of 1800° F and above; and (2) fuel sulfur increased metal loss for some superalloys at 1600° F and below. Author

N64-31632 Phillips Petroleum Co., Bartlesville, Okla. Research Div.
EFFECT OF JP-5 SULFUR CONTENT AND SEA WATER INGESTION ON HOT GAS CORROSION OF SUPERALLOYS Progress Report No. 3
R. M. Schirmer, H. T. Quigg, and R. A. Mengelkamp [1964] 76 p refs
(Contract NOw-63-0406-d)
(Rept.-3686-64R; AD-602152)

Specimens of two nickel-base alloys were exposed to vitiated air from the Phillips 2-in. combustor (56 air–fuel ratio) at high temperature (2,000° F), high pressure (15 atm), and high velocity (500 fps) during a 5-hr cyclic test (55 min. fuel-on and 5 min. fuel-off). A statistically designed test program was used to evaluate the effect of three sulfur concentration levels in the fuel (0.0002, 0.040, and 0.40 wt. %) at three sea salt concentration levels in the air (zero, 1.50, and 15.0 ppm), and also any sulfur × sea salt interaction. The significance of test specimen metal losses and changes in tensile properties was established by analyses of variance, made at a confidence level of 95%. Author

N64-31686 Battelle Memorial Inst., Columbus, Ohio
EFFECT OF ELECTRON CONCENTRATION ON MECHANICAL PROPERTIES OF ALLOYS OF REFRACTORY METALS Annual Topical Report
J. G. Booth 17 Oct. 1963 43 p refs
(Contract Nonr-3589(00))
(AD-421178)

The effect of additions of rhenium on the microstructural and electronic structural properties of Group VI-A refractory metals is being investigated. Interstitial solubility, segregation, and precipitate morphology are discussed. Measurements of physical, magnetic, and electrical properties were made to aid in the understanding of the band structure of the rhenium alloys. R.L.K.

N64-31708 Chance Vought Corp., Dallas, Tex. Aeronautics and Missiles Div.
RESEARCH TO DEVELOP A NICKEL BASE ALLOY SHEET FOR HIGH TEMPERATURE APPLICATION Progress Report, 1 Jun.–30 Sep. 1963
D. P. Duff, W. H. Sparrow, and G. A. Starr 10 Oct. 1963 13 p ref
(Contract AF 33(657)-11160)
(Rept.-2-53431/3R-478; AD-420655)

Six heats of Inco 713c were melted and cast into plates 0.125 in. thick. The plates were then hot rolled on a rigid rolling mill to 40 mil thickness. The rolled sheet was heat treated, inspected, and cut into specimen blanks for tensile and stress-rupture testing. The tensile test portion of the program, which included tests on both Inco 713 and René 41 at 1900° and 1700° F, has been completed. The average ultimate tensile strength of Inco 713c at 1900° F was 51 200 psi with 4% elongation, which was considerably greater than the 15 900 psi ultimate tensile strength and 37.8% elongation of the René 41 tested under the same conditions. Author

N64-31883 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOLDERING OF TITANIUM ALLOY AT-3 WITH APPLICATION OF VARIOUS GALVANIC COVERINGS
A. Ya. Shinyayev and V. V. Bondarev 11 Jun. 1964 9 p refs
Transl. into ENGLISH from Titan i Yego Splavy, Akad. Nauk SSSR, Inst. Met. (Moscow), no. 10, 1963 p 317–321
(FTD-MT-64-48; AD-602336)

Experimental evidence that galvanic coverings of silver, rhenium, or rhodium from 15μ to 25μ thick can reliably protect AT-3 titanium sheet from oxidation and interaction with solder components during soldering is presented. Maximum weld strength is attained by soldering at 780° to 790° C for silver coverings, 790° to 800° C for rhenium coverings, and 800° to 810° C for the rhodium coverings, which is in accord with the rates of diffusion mobility of these atoms. Electron microscope investigations showed that the diffusion zone represented a solid solution of titanium with the galvanic covering material. M.P.G.

N64-31895 Aerojet-General Corp., Sacramento, Calif.
EVALUATION OF HIGH NICKEL STEEL FOR APPLICATION IN LARGE BOOSTER MOTOR FABRICATION Technical Documentary Report, 31 May 1962–31 Jan. 1964
W. S. Tenner et al Wright-Patterson AFB, Ohio, AF Mater. Lab., Apr. 1964 398 p refs
(Contract AF 33(657)-8740)
(ML-TDR-64-115; AD-605862)

The tensile, aging response, and fracture toughness properties of seven heats of 18% nickel maraging steel plate and bar stock with yield strength values ranging from 200 to 300 ksi was evaluated, and the results of this investigation were correlated with material melting and processing practices. In addition to the basic physical material properties that were studied, metallurgical properties also were studied to determine the grain size, general microstructure, inclusion content, and banding characteristics of these heats of material. Relationships between yield strength, fracture toughness, and alloy composition were established. Fracture toughness correlation studies were conducted using the part-through-crack tensile, center-notch tensile, precrack-Charpy and slow-notch-bend test specimens. Author

N64-31968 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Materials Lab.
ELEVATED TEMPERATURE TENSILE AND CREEP PROPERTIES OF M-252 (BAR), INCONEL 700 (BAR), AND INCONEL 713 (CAST) NICKEL BASE ALLOYS
Sidney O. Davis Jul. 1964 50 p
(ML-TDR-64-79; AD-606108)

Room and elevated temperature tensile and elevated temperature creep properties to 1000 hours were determined at three representative application temperatures for M-252 (bar), Inconel 700 (bar), and Inconel 713 (cast). Tabulated tensile and creep data, deformation-versus-time curves, and stress-versus-time curves for 0.1%, 0.3%, 0.5%, and 1% creep are presented. Author

N64-31970 Tem-Pres Research, Inc., State College, Pa.
RESEARCH ON CRITERIA FOR SELECTION OF ALLOYS AND SURFACE TREATMENTS FOR INHIBITION OF TUNGSTEN OXIDATION. PART I: STUDIES ON THE CHEMICAL AND PHYSICAL PROPERTIES OF TERNARY PHASES CONTAINING TUNGSTEN AND OXYGEN Technical Documentary Report, Jul. 1, 1963–Jun. 30, 1964
Bert Phillips, Luke L. Y. Chang, and Margaret G. Scroger Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1964 69 p refs
(Contract AF 33(657)-11235)
(ML-TDR-64-230, Pt. I; AD-605892)

Sealed capsules were used to equilibrate pelletized samples from which data were obtained on the condensed phase relations in the systems W-O, Ti-W-O, Ca-W-O, Sm-W-O, and Co-W-O. The system W-O up to 1700° C, and isothermal sections for the ternary systems at 1400° C and 1700° C are presented. The positions of the oxygen isobars in the system W-O have been calculated from published thermodynamic data and extrapolations. The processes whereby changes in condensed phase assemblages occur as a function of oxidation of tungsten-metal alloys and mixtures are illustrated with examples. The ternary tungstates that are thermodynamically stable in the systems studied have been characterized as to X-ray diffraction pattern and melting temperature. Where possible, crystallographic information is also given. Author

N64-32028 Brown U., Providence, R.I. Engineering Div.
OBSERVATIONS ON THE INITIATION OF FRACTURE IN ALUMINUM-SILICON ALLOYS
A. Gangulee and J. Gurland Sep. 1964 21 p refs
(Contract AT(30-1)-2394)
(TR-8)

The cracking of silicon particles, during the early stages of deformation of Al-Si alloys, occurs progressively over a range of stress. The fracture probability of the particles is proportional to a stress-structure parameter: $\sigma\ (d^{1/2}/f^{1/3})$, based upon a simple dislocation model. The experimental evidence indicates preferred cracking of the larger particles and, in general, supports the view that cracks in the silicon particles are preceded by slip in the matrix. Author

N64-32055 United States Steel Corp., Monroeville, Pa. Applied Research Lab.
EVALUATION OF 3Ni-Cr-Mo STEELS
S. J. Manganello and L. F. Porter 1 Apr. 1964 34 p refs
(Contract NObs-88540)
(S-11211; AD-600934)

Investigated was the extent to which nickel, vanadium, columbium, and/or tantalum would improve the hardenability, temperability, and mechanical properties of four 0.25% carbon and four 0.15% carbon 3Ni-Cr-Mo steels. The results indicated that the 0.25% carbon steels had just sufficient hardenability for 4-in.-thick water-quenched plates, but that the 0.15% carbon steels did not have sufficient hardenability. The addition of vanadium, columbium, and/or tantalum increased the resistance of the 0.25% and the 0.15% carbon steels to softening during tempering. However, these additions generally reduced the Charpy V-notch energy absorption of the 0.25% carbon steels but did not reduce the energy absorption of the 0.15% carbon steels that were cooled rapidly enough so that they fully hardened. Author

N64-32076 France. Service Technique de l'Aeronautique, Paris Section des Materiaux
INVESTIGATION ON CAST MOLYBDENUM Final Report
30 Jun. 1963 128 p
(Rept.-4; AD-421571)

Using production methods reported on previously, several industrial castings have been made and submitted to a series of characterization tests. The chemical methods for the assay of impurities have been improved and are described. The effects

that carbon and oxygen are likely to have upon the workability and mechanical properties of molybdenum are detailed. Finally, an account is given of initial results in the production and working of Mo-Ti and TZM alloys. A.W.

N64-32098 IIT Research Inst., Chicago, Ill. Technology Center
VANADIUM ALLOY STUDIES Bimonthly Report No. 2, Apr. 1–May 31, 1964
D. Weinstein and F. C. Holtz 1 Jul. 1964 12 p ref
(Contract NOw-64-0239-C)
(IITRI-B6021-2; AD-602123)

Vanadium development studies are being conducted to significantly improve short-time (minutes to a few hours) creep properties at temperatures between 2000° and 2400° F. Tantalum additions to the V-Cb-Ti base composition result in a significant improvement in creep properties. Author

N64-32129 Joint Publications Research Service, Washington, D.C.
PRODUCTION AND TREATMENT OF NON-FERROUS ALLOYS
V. I. Shilov et al 8 Oct. 1964 17 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), v. 37, no. 7, Jul. 1964 (JPRS-26789; TT-64-51046) OTS: $1.00

CONTENTS:

1. SPECIFIC COLD-WORKING PRESSURE FOR TITANIUM ALLOYS V. I. Shilov and V. P. Korzh p 1–6 refs
2. PRODUCTION OF NIOBIUM-BASE ALLOYS BY CARBOTHERMIC REDUCTION OF THE OXIDES O. P. Kolchin, N. P. Chuveleva, and N. V. Sumarokova p 7–14 refs

N64-32147 Rocketdyne, Canoga Park, Calif.
STRENGTHENING IRON-BASE ALLOYS BY SHOCK WAVES Quarterly Progress Report, 1 Jun.–15 Oct. 1963
R. J. Thompson 30 Oct. 1963 33 p refs
(Contract AF 33(657)-11250)
(R-5413-1; AD-421914)

Detailed technical plans for a program investigating the effects of shock waves on strengthening mechanisms of iron-base alloys have been completed. Outlines of each portion of the work are presented. Procurement of materials to be used in the program has been completed. The specimen materials have been heat treated, and measurements of their hardness and tensile properties have been made. Photomicrographs have been made of all specimens. Calibration of an explosive plane-wave generator designed to give pressures above 250 kb has been completed, and shocking of specimens is under way. Author

N64-32179 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
MECHANICAL AND PHYSICAL PROPERTIES OF THREE SUPERALLOYS—MAR-M200, MAR-M302, AND MAR-M322
John A. Van Echo and Ward F. Simmons 6 May 1964 34 p refs
(Contract AF 33(615)-1121)
(DMIC-MEMO-193; AD-605373)

A nickel-base alloy, MAR-M200 (formerly designated SM-200), and two cobalt-base alloys, MAR-M302 (formerly SM-302) and MAR-M322 (formerly SM322) were tested in several laboratories. Their chemical compositions and physical properties are described. Sheets of raw data are supplied, and data curves are plotted for short-time tensile strength, 0.2% offset yield strength, elongation, reduction of area, stress-rupture strength, elastic modulus, coefficient of expansion, thermal conductivity, and specific heat. All three alloys are designed for vacuum melting and vacuum casting in either shell- or investment-type molds. The alloys have sufficient strength to be used in the as-cast condition, but MAR-M200 can be heat treated for increased strength and ductility in the lower temperature ranges. The solidus temperature of the alloys is in the range of 2400° to 2450° F. The alloys appear to have useful strength potential to 2100° F and perhaps even higher. R.L.K.

N64-32279 New England Materials Lab., Inc., Medford, Mass.
HIGH TEMPERATURE DEFORMATION AND FRACTURE BEHAVIOR OF METALS UNDER HIGH STRAIN RATE CONDITIONS Progress Report, 1 Jul.–31 Aug. 1963
R. Widmer, J. M. Dhosi, J. S. Benjamin, and N. J. Grant Oct. 1963 20 p
(Contract NOw-63-0502-c)
(PR-2; AD-420919)

High strain-rate tensile tests of Udimet 700 and beryllium were performed on a modified constant-load creep machine. On a Udimet 700 ingot tested at 1800°, 1900°, 2000°, 2100°, and 2200° F, over a range of strain rates of 0.003 in./in./sec to 6 in./in./sec, ductility decreased with increase of strain rate. It was shown that there is an optimum hot-working temperature above which ductility values decrease. Beryllium tested at 700°, 1100°, and 1300° F, with strain rates from 0.0016 in./in./sec to 3.1 in./in./sec, showed ductility decreasing at 700° F with increase of strain rate, and increasing at 1100° F and 1300° F. A.W.

N64-32286 North American Aviation, Inc., Los Angeles, Calif.
WELDING CHARACTERISTICS, EXHIBIT "D" Quarterly Progress Report No. 1, 1 Jul.–30 Sep. 1963
P. A. Beeson 18 Oct. 1963 50 p refs Prepared jointly with Boeing
(Contract AF 33(657)-11461)
(BNJY-D-Q1)

The scope of the program involves the evaluation of Inconel 718 (20% cold reduced), 8Al-1Mo-1V titanium alloy (duplex annealed), PH14-8Mo (SRH 1050), and a fourth material for weldability and welded joint strength using fusion-welding and resistance-welding techniques. A comprehensive literature survey has been conducted to systematically and objectively review and tabulate known welding and brazing techniques and characteristics. The weldability studies of 8Al-1Mo-1V titanium alloy and PH14-8Mo precipitation-hardening stainless steel are underway, and preliminary data are presented. The base material tests completed to date are reported. Author

N64-32304 Joint Publications Research Service, Washington, D.C.
CARBURIZING AND HEAT TREATABLE STEELS DI-2, DI-3, DI-3A (EP-176) AND DI-4
M. F. Alekseyenko, G. I. Vasilenko, B. S. Natapov, G. N. Orekhov, M. V. Pridantsev et al 19 Oct. 1964 9 p refs Transl. into ENGLISH from Stal' (Moscow), no. 7, Jul. 1964 p 642–645 (JPRS-26959; TT-64-51215) OTS: $1.00

The authors created a group of low-nickel carburizing steels that, by their physical and mechanical properties, are on a par with high-nickel steels and possess optimum properties of the carburized layer in parts. Use was made of scrap Cl-Ni-Mo steels in the development of these new grades. The new steels have a high fatigue strength and an adequate impact strength. They can also be nitrided and, because of the increased temperature required for softening during tempering, can be recommended for use in parts operating at temperatures up to 250° to 300° C. A.W.

N64-32363 Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center
EVALUATION OF SPECIAL METAL PROPERTIES Thirteenth Review of Recent Developments, 1 Dec. 1963–30 Feb. 1964
J. E. Campbell 20 Mar. 1964 4 p refs

Results of studies on the properties of titanium alloys from room temperature to −423° F are summarized in graphic form. Also data from shallow-cracked fracture specimens of Ti-6Al-4V, D6ac steel, and 18Ni maraging steel are presented graphically. The graphs show the following: (1) the effect of shallow-crack depth on the transverse fracture stress of 0.050-inch annealed Ti-6Al-4V alloy; (2) the effect of shallow-crack depth on the transverse fracture stress of 0.050-inch Ti-5Al-2.5Sn alloy; (3) the gross stress versus crack area for shallow-cracked specimens of three Ti-6Al-4V materials; and (4) the gross stress versus crack area for shallow-cracked specimens of maraging steel and D6ac steel. Conclusions reached as a result of the study include these: biaxial S-N curves have the same general shape as uniaxial S-N curves; and the R-factor (minimum stress–maximum stress) effects biaxial fatigue life in the same manner as it does uniaxial fatigue life. P.V.E.

N64-32378 National Research Corp., Cambridge, Mass. Metals Div.
RESEARCH ON THE TECHNOLOGY OF TANTALUM ALLOYS WITH MAXIMUM STRENGTH IN THE 3000°F TO 3500°F RANGE Quarterly Progress Report, 1 Jun.–31 Aug. 1963
R. W. Douglass Sep. 1963 12 p
(Contract AF 33(657)-11255)
(QPR-1; AD-448778)

The Ta-10W alloy has been selected as the most suitable base for the development of a high-strength, ductile alloy for service in the 3000° to 3500° F range. One hundred and ten alloys represent several different approaches to improve high-temperature strength. Forty-five of these alloys have been melted and are ready for fabrication. Sintering experiments of prealloyed Ta-10W powder have been conducted; preparations have been made for nitriding tantalum base alloys. Author

N64-32403* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
TENSILE COUPON TESTS OF CRYOFORMED AISI 301 STAINLESS-STEEL PRESSURE VESSELS AT CRYOGENIC TEMPERATURES
Thomas W. Orange Washington, NASA, Oct. 1964 23 p refs
(NASA-TN-D-2202) OTS: $0.75

The purpose of the present investigation was to determine the tensile characteristics of cryoformed AISI 301 stainless steel at temperatures from ambient to −423° F. Cylindrical pressure vessels that were fabricated by cryoforming were cut into coupons from which smooth and sharp-notch tensile specimens were made. Coupons from the longitudinal-seam-weld area were used to evaluate weld efficiency and notch sensitivity. These specimens were tested at ambient temperature, −320° F, and −423° F. Results were compared with like properties for AISI 301 stainless steel cold-reduced 60% and 70%. Author

N64-32408 United States Steel Corp., Monroeville, Pa.
THE EFFECT OF SPECIAL ADDITIONS ON THE NOTCH TOUGHNESS OF MARAGING STEELS
A. J. Birkle, D. S. Dabkowski, and L. F. Porter [1964] 26 p refs
(AD-600932) OTS: $2.00

A laboratory study was initiated to determine whether special additions of boron and zirconium were related to the observed poor notch toughness. The results indicated that when air-melted or vacuum-melted heats of 12Ni-3Cr-3Mo, 12Ni-5Cr-3Mo, or 18Ni-8Co-3Mo maraging steels contained about 0.02% zirconium, their notch toughness in the solution-annealed and in the solution-annealed and aged conditions was markedly lower than that of the same steels containing no boron or zirconium or containing only boron. The results also indicated that the steels containing boron were slightly more notch tough than the steels containing no boron or zirconium, and that the steels containing about 0.005% carbon were more notch tough than the steels containing about 0.017% carbon. In addition, there was some indication that the elimination of aluminum may also significantly improve notch toughness. Author

N64-32409 National Academy of Sciences-National Research Council, Washington, D.C. Prevention of Deterioration Center
PERFORMANCE ABOVE 1000°F OF SUPERALLOYS AND PROTECTIVE COATINGS
R. G. Lyle and R. C. Peden, comp. Dec. 1963 56 p refs
(PDC-Search-63-050; PDL-50140; AD-601295) OTS: $3.00

This annotated bibliography gives references to documents in the Prevention of Deterioration Center Library on superalloys and protective coatings for hot-section application. Subjects emphasized include resistance to oxidation, erosion, corrosion, carburization, sulfurization, and spalling, and mechanical property data that include fatigue. Emphasis is placed on nickel- and cobalt-base alloys, although references are included on selected iron- and chromium-base alloys. D.E.W.

N64-32426* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF THE INFLUENCE OF LOAD RANDOMIZATION AND OF GROUND-AIR-GROUND CYCLES ON FATIGUE LIFE
Eugene C. Naumann Washington, NASA, Oct. 1964 37 p refs
(NASA-TN-D-1584) OTS: $1.00

Variable-amplitude axial-load fatigue tests were conducted on 2024-T3 and 7075-T6 aluminum-alloy edge-notched sheet specimens having a theoretical elastic stress concentration factor of 4. The load programs were designed to approximate a gust-load spectrum. The introduction of ground–air–ground cycles sharply reduced the fatigue life. The amount of the reduction in fatigue life was found to be influenced by ground–air–ground cycle range, relative frequency of occurrence of the ground–air–ground cycle, and the degree of load randomization present in the tests. Omitting small amplitude loads did not have an appreciable effect on fatigue life. A new programed variable-amplitude axial-load fatigue machine is described.

N64-32427* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
DETERMINATION OF LESS THAN 10 PARTS PER MILLION CARBON IN TUNGSTEN
William A. Gordon, Judson W. Graab, and Zita T. Tumney Washington, NASA, Oct. 1964 15 p refs
(NASA-TN-D-2153) OTS: $0.50

In the combustion-conductometric method the smallest detectible quantity of carbon is limited by errors introduced by a spurious carbon blank. Also, the accuracy of the method for refractory metals is unknown, since quantitative calibration is based on recoveries of carbon from steel samples or on organic compounds. Studies of the control of these possible sources of error resulted in establishing conditions whereby carbon concentrations of 4 ppm may be determined with a precision of

±12% and an estimated accuracy of ±15% relative. These conditions appear to be directly applicable to other metals, including niobium, tantalum, titanium, zirconium, chromium, and copper. Author

N64-32439 Battelle Memorial Inst., Columbus, Ohio
FURTHER INVESTIGATION OF NOTCH SENSITIVITY OF REFRACTORY METALS Bimonthly Progress Report, Apr. 1–May 31, 1964
C. W. Marschall, F. C. Holden, A. Gilbert, and B. A. Wilcox
10 Jun. 1964 12 p refs
(Contract AF 33(657)-10363)
(BPR-1; AD-447845)

Materials are being obtained for a study of the effects of 1-mil silicide coating and elevated-temperature exposure in an oxidizing atmosphere on the fracture toughness of 0.030-in.-thick TZM-molybdenum alloy and D43-niobium alloy sheet material. Both center-cracked and unnotched specimens will be tested over a wide range of temperature, encompassing the ductile-to-brittle transition range. In studies of the mechanism of crack propagation, work has started on the following: (1) tests of the Battelle crack-propagation models by predicting the strain-rate effect on the ductile-to-brittle transition temperature of molybdenum sheet; and (2) development of tests to measure "crack-stop" temperatures in molybdenum sheet. M.P.G.

N64-32479 Massachusetts Inst. of Tech., Cambridge High Temperature Materials Labs.
INVESTIGATION OF THE STRENGTHENING MECHANISMS OF DISPERSION STRENGTHENED ALLOYS Technical Documentary Report, 1 Feb. 1963–29 Feb. 1964
Richard J. Murphy and Nicholas J. Grant Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 35 p refs
(Contract AF 33(657)-10751)
(ASD-TR-62-734, Pt. II; AD-606494)

Diffusion couples of dilute alloys of Ni-C and Ni-Ti, as well as of Ni-B and Ni-Ti, were studied to determine the conditions necessary for the formation of a fine dispersion of TiC and TiB_2 in nickel. TiB_2 was found to be unsuitable for this type of application. Nickel-base alloys with a dispersion of TiC were prepared by several powder metallurgical techniques, as well as by internal carburization of Ni-Ti chips. The mechanical properties of these alloys were studied at room temperature and 815° C, and a comparison was made with the properties of conventional alloys reported for these temperatures. Transmission electron microscopy was used to study the elastic strain fields associated with dispersoid particles in the Ni-Al_2O_3 and Cu-Al_2O_3 systems, prepared by internal oxidation. Author

N64-32533 Aerojet-General Corp., Azusa, Calif. Von Karman Center
STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS Final Report, 1 Jul. 1963–1 Jul. 1964
A. Rubin Aug. 1964 51 p refs
(Contract DA-04-495-ORD-3089)
(Rept.-2914; AD-604750)

The stress-corrosion characteristics of 18%-nickel maraging steel with respect to compositional variation are reported. The effect of environmental temperature on the rate of stress-corrosion cracking is discussed for 18%-nickel maraging steel, for a low-alloy martensitic steel, and for a hot-worked die steel. The electropotential changes in 18%-nickel maraging steel during stress-corrosion exposure were studied and are described along with the effect on these changes of applied potential. D.E.W.

N64-32540 Office of Naval Research, London (Gt. Brit.)
METALLURGICAL RESEARCH IN GREAT BRITAIN: PART VI: UNIVERSITY OF CAMBRIDGE AND UNIVERSITY OF MANCHESTER
Walter Beck 28 Aug. 1964 11 p
(ONRL-47-64; AD-446501)

At the University of Cambridge research includes the investigation of the effectiveness of sodium, calcium, and lead salts of long-chain fatty acids and of products of the autoxidation of the lead soaps of the linseed oil fatty acids to protect against corrosion; work in aqueous soil electrolytes; initiation of pores in anodic oxide films; and mechanochemical anodic dissolution of austenitic stainless steel. Discussion of the University of Manchester includes an account of research in the structure of metallic meteorites, metals in stony meteorites, and physical–chemical relationships between the silicate phases of stony meteorites. A.W.

N64-32546 Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
FRACTURE TOUGHNESS, FATIGUE-CRACK PROPAGATION AND CORROSION CHARACTERISTICS OF ALUMINUM ALLOY PLATES FOR WING SKINS Quarterly Report, Jun. 3–Sep. 3, 1964
G. E. Nordmark, B. W. Lifka, and J. G. Kaufman 15 Sep. 1964 117 p refs
(Contracts AF 33(657)-11155; AF 33(615)-2012)
(AD-447686)

Fracture-toughness tests of 2024-T851, 7075-T651, 7075-T7351, and 7079-T651 are complete. Of the four alloys, 7075-T7351 has the greatest toughness and 2024-T851 has the least toughness under plane-strain or mixed-mode fracture conditions. The fatigue tests to date of center-notched and bolted-joint specimens of 7075-T651 and 7079-T651 indicate that there is no consistent difference between the fatigue strengths of the different lots of either alloy or of the two alloys themselves; the fatigue strengths of 2024-T851 are slightly lower than those of the other two alloys. All of the corrosion specimens have been placed in the test environments; some short-time data are available. Author

N64-32548 Frankford Arsenal, Philadelphia, Pa.
DETERMINATION OF IRON, NICKEL, COPPER, AND COBALT IN TUNGSTEN AND TUNGSTEN ALLOYS
George Norwitz and Herman Gordon Aug. 1964 22 p refs
(T65-1-1; AD-605932)

Iron, nickel, copper, and cobalt in tungsten and tungsten alloys are analyzed spectrophotometrically by taking aliquots of a hydrofluoric–nitric acid solution that has been buffered to a pH of 6 by the addition of ammonium tartrate and sodium borate. No subsequent adjustment of pH is necessary for the spectrophotometric determination of the iron, copper, or cobalt. Large amounts of iron are determined titrimetrically after sodium hydroxide and ammonium hydroxide precipitations. A direct method for the gravimetric determination of large amounts of nickel in tungsten with dimethylglyoxime by use of the ammonium tartrate–sodium fluoborate buffer system is described. Copper is determined electrolytically after dissolution in hydrofluoric and nitric acids and addition of hydrogen peroxide. Large amounts of cobalt are determined potentiometrically with potassium ferricyanide. Author

N64-32582 Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
PILOT PRODUCTION AND EVALUATION OF TANTALUM ALLOY SHEET. PART II Summary Phase Report, 15 Feb. 1963–15 Apr. 1964
R. L. Ammon and R. T. Begley 1 Jul. 1964 101 p refs
(Contract N600(19)59762)
(WANL-PR-M-009; AD-604173)

Pilot quantities of T-222(Ta-9.6W-2.4Hf-0.01C) sheet were produced from 3-in.-diam ingots and evaluated. The T-222 alloy exhibited a significant improvement in elevated-temperature mechanical properties over those of the solid solution alloy T-111(Ta-8W-2Hf). The improvement in mechanical properties was achieved with little or no loss of fabricability or weldability. The effect of higher tungsten, hafnium, and carbon concentrations on the properties of T-222 was also investigated. Increasing the solute concentration of T-222 from 12% to 14% at a W-Hf ratio of 4:1, with the standard 0.01% carbon content, produced a slight improvement in the elevated temperature mechanical properties without adversely affecting fabricability or weldability. Increasing the carbon content of T-222 from 0.01% to 0.04% did not produce any significant improvement in elevated temperature mechanical properties; however, the weld-bend transition temperature was raised to above room temperature. Substitution of nitrogen for carbon in T-222 resulted in no gross change in mechanical or weld properties. Author

N64-32622 Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
INVESTIGATION TOWARD OBTAINING SIGNIFICANTLY HIGHER MECHANICAL PROPERTIES OF AS-WELDED JOINTS IN HIGH-STRENGTH, HEAT-TREATABLE ALUMINUM ALLOYS Final Report
James R. Terrill 30 Jul. 1964 104 p refs
(Contract DA-36-034-ORD-3237A)
(Rept.-2-64-16; AD-603733)

Local heat treatment of welds for 10 minutes at 885° F followed by cold-water quenching and artificial aging markedly improved mechanical properties of welded 7178-T6 aluminum alloy sheet. Nipple-shaped beads characteristic of DCRP-GMA welds made with brine cooling were reproduced in 0.090-in. 2014-T6 sheet without a refrigerated backing bar by proper balance of energy input and shielding gas flow during welding. Copper-free Al-Zn-Mg alloys DCSP-GTA, welded with compatible fillers and postweld artificially aged, developed remarkably high strengths with excellent longitudinal ductility but high susceptibility to stress-corrosion cracking. With bead reinforcement intact, tensile failures occurred in base metal 1/4 to 1/2 inch from the weld. The best combination, based on both strength and ductility, was Al-6.5Zn-2.5Mg base metal welded with Al-9Zn-2Mg filler. Author

N64-32652 Pressure Technology Corp. of America, Woodbridge, N.J.
AN INVESTIGATION OF Be AND W ALTERED BY HIGH-PRESSURE DEFORMATION Engineering Progress Report, 7 Jan.–7 Mar. 1964
[1964] 18 p refs
(Contract NOw-64-0180-c)
(EPR-1; AD-449611)

Materials have been procured of Be and W for tensile tests and fluid-to-fluid extrusion. Specimens have been prepared for test, and apparatus is ready to begin deformation experimentation. A literature survey was made of cold deformation of Be and W. Author

N64-32659 Syracuse U. Research Inst., N.Y.
AEROSPACE STRUCTURAL METALS HANDBOOK Quarterly Progress Report No. 2, Apr. 1–Jul. 1, 1964
J. G. Sessler and V. Weiss Wright-Patterson AFB, Ohio. AF Mater. Lab., Jul. 1964 10 p
(Contract AF 33(615)-1184)
(MET. E-1161-0764-QP2; AD-449757)

The program to revise, expand, and improve the "Aerospace Structural Metals Handbook" is continuing according to plan. First drafts of 2 new alloy chapters are completed and 8 chapters are in progress. Also, a sample demonstration package of document reference cards and data storage cards is being prepared. Author

N64-32664 Brown U., Providence, R.I.
EXHAUSTION OF DUCTILITY AND BRITTLE FRACTURE OF E-STEEL CAUSED BY PRESTRAIN AND AGING MACROFRACTURE FUNDAMENTALS Second Progress Report
C. Mylonas Jul. 1964 41 p refs
(Contract NObs-88294)
(SSC-162; AD-603214)

The investigation of static brittle fracture initiation in engineering structures requires first the establishment of a criterion of brittle behavior of the structure as a whole. Such a criterion is obtained by a comparison of the fracture load with the flow limit of an idealized perfectly plastic material. The difference between static fractures at high and low load was related to the magnitude of the plastic strains at regions of strain concentration and to the ductility of the steel. The contrast between static laboratory tests of notched plates of sound steel that did not fracture before the flow limit was reached, and service failures that have occurred at low nominal stress levels, shows that the ductility of sound steel is sufficient to avoid low average stress fracture, but may be reduced during fabrication or in service. This was demonstrated experimentally with extensive tests of prestrained notched plates, bent bars, and axially compressed bars. Author

N64-32670 Naval Research Lab., Washington, D.C. Metallurgy Div.
IN-DEPTH EMBRITTLEMENT OF A SIMULATED PRESSURE VESSEL WALL OF A302-B STEEL
C. Z. Serpan, Jr. and L. E. Steele 4 Sep. 1964 11 p refs
(NRL-6151; AD-606696)

Because of the self-shielding and attenuation properties of the vessel material, a nuclear reactor pressure vessel will have a neutron flux and spectrum variation across its thickness. As a result of this variation, a pressure vessel should show various degrees of neutron-induced embrittlement throughout its thickness, and it is postulated that the embrittlement will be greatest at the inner wall and least at the outer wall. This phenomenon has been investigated by the irradiation of a large block of A302-B steel at the core face of a pool reactor in a position simulating the location of an actual pressure vessel. The notch ductility test results of the irradiated specimens demonstrate a significant degree of embrittlement as well as a significant decrease in the degree of embrittlement through the simulated pressure vessel wall. However, the observed decrease is small when related to the respective variation in neutron dosage. Author

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-31426 Naval Research Lab., Washington, D.C. Chemistry Div.
SURFACE CHEMISTRY OF GLASS-FIBER-REINFORCED PLASTICS
W. A. Zisman [1964] 13 p refs Presented at the 19th Ann. Exhibit and Conf. of the Soc. of Plastics Ind., Inc., Chicago, 6 Feb. 1964
(NRL-6083; AD-601581) OTS: $1.00

This report attempts to apply present knowledge of surface chemistry and polymer chemistry to explain many of the properties of glass-fiber-reinforced plastics and to point out ways to obtain improvements. In most respects, the analysis given also applies to any plastic reinforced by a fibrous solid material whose surface is hydrophilic. Author

N64-31655 Pennsylvania State U., University Park
DYNAMIC STRESS-STRAIN BEHAVIOR OF MATERIALS Final Report No. 3, Jul. 1, 1963–Jul. 1, 1964
M. G. Sharma, V. H. Neubert, and J. Marin [1964] 8 p refs
(Grant DA-ARO(D)-31-124-G153)
(AROD-3263-8; AD-443928)

This is a report on dynamic stress–strain behavior studies of materials. The following subjects were investigated: "Dynamic Behavior of Plastics"; "High Strain Rate Behavior of Materials"; and "Biaxial Low Strain Cycling Behavior of Materials." G.G.

N64-31799 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALYSIS OF CIS-BUTADIENE RUBBER BY THE INFRARED SPECTROSCOPY METHOD
A. P. Kastorskiy and I. N. Mednikova 26 Aug. 1964 7 p refs Transl. into ENGLISH from Kauchuk i Rezina (Moscow), no. 3, 1963 p 55–57
(FTD-TT-64-459/1+2; AD-605802)

A method of determining the structure of cis-butadiene rubber is described. In the method, a film of the polymer is applied by evaporation from a solution to a plate of sodium bromide or rock salt. An infrared photograph is then taken of the film, and its optical densities are determined. From the optical density data, the content of the determinable links in the polymer is computed. The absorption band at 1440 cm^{-1} is used as an internal standard. P.V.E.

N64-32019 Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands) Chemistry Section
SHIPBOARD APPLICATION OF PLASTICS AND GLASS-REINFORCED PLASTICS FOR PIPELINES [KUNSTSTOFLEIDINGEN AAN BOORD VAN SCHEPEN]
J. F. van der Vate Oct. 1963 95 p refs In DUTCH; ENGLISH summary
(TDCK-36363)

This report gives a survey of the most important aspects of the shipboard application of plastics and glass-reinforced plastics for pipelines. Prevention of corrosion by means of plastics is the starting point. Glass-reinforced plastics appear to be provisionally unusable. Generally plastics may be used for cold piping provided no danger exists for reduced maneuverability and security of the ship. Some possibilities are plastic potable water, drain, and sanitary piping and speaking tubes. Plasticization and foam insulation are discussed briefly; paint systems and hoses are mentioned incidentally. Author

N64-32064 Franklin Inst., Philadelphia, Pa. Research and Development Labs.
AN EVALUATION OF DATA COLLECTIONS FOR PLASTICS
Gunther Cohn and Carol Carr May 1964 50 p refs
(Contract DA-36-034-501-AMC-0119A)
(I-B2104-1; AD-602085) OTS: $1.25

Recommendations are made for a data system suitable for the Plastics Technical Evaluation Center on the basis of a study of various aspects of data and existing data systems. The data sources available include unpublished information, reports, and open literature in plastics. Data exist either in tabular or graphic form and may be critical or unevaluated. Methods for handling data range from manual to machine, and information can be filed by material, property, or by a random access method. The existing data systems provide examples of the various methods available for handling data. Although some existing systems handle plastics data, the coverage is not complete and there still remains a need for a unified data center in plastics. A manual system consisting of data sheets filed by material is recommended for the present. This system can easily be converted for machine storage and retrieval, if necessary. Author

N64-32196 Telecomputing Corp., San Diego, Calif. Narmco Research and Development Div.
INTERLAMINAR SHEAR OF FILAMENT-WOUND REINFORCED PLASTICS Annual Summary Report, 28 Jun. 1963–30 Jun. 1964
Robert A. Elkin 30 Jul. 1964 48 p refs
(Contract N60921-7094)
(AD-603565)

One of the newer epoxy resins (ERLA 0400) used in the screening studies exhibited interlaminar shear strengths in excess of 15 000 psi. By winding fibers in the third planar direction, the apparent interlaminar shear strength of the ring-type specimens was increased by approximately 30%. Although the test data were not completely conclusive, results indicated that the triplanar winding increases both the ultimate compression strength and fatigue resistance of circumferentially wound cylinders. Author

N64-32221 North American Aviation, Inc., Columbus, Ohio
INVESTIGATION OF ELECTRICALLY CURED STRUCTURAL ADHESIVES First Interim Engineering Progress Report, 1 Jan.–31 Mar. 1964
John P. Tipton, H. B. Corson, R. K. Newsome, and R. P. Steen [1964] 39 p
(Contract AF 33(615)-1182)
(NA-64H-377-1; AD-447837)

The major accomplishments of the program to date have been the following: (1) procurement of equipment and materials; (2) familiarization with both the conventionally and electrically cured adhesive systems; (3) circuitry design and refinement; and (4) preparation and preliminary testing of qualification test specimens. Author

N64-32250 Forest Products Lab., Madison, Wisc.
EFFECT OF TENSILE MEAN STRESSES ON FATIGUE PROPERTIES OF PLASTIC LAMINATES REINFORCED WITH UNWOVEN GLASS FIBERS

Kenneth H. Boller Wright-Patterson AFB, Ohio. AF Mater. Lab., Mar. 1964 38 p refs
(Contract AF 33(657)-63-358)
(ML-TDR-69-86; AD-605412)

Fatigue curves are presented for plastic laminates reinforced with layers of unwoven E-glass filaments in a matrix of epoxy-type resin and subjected to various alternating stress amplitudes, superimposed on constant mean tensile loads. The S-N curves were determined by axially loading specimens that had alternate layers of glass at 0°, ±5°, ±10°, and ±15° to the principal axis. Curves were also determined for three special constructions of unwoven glass laminates in which 71.4% of the fibers were parallel to the principal axis, 85.2% were parallel, and all layers were parallel with each layer supported by a "carrier" of 2-mil glass fabric. All experiments were conducted on unnotched specimens, at 900 cycles per minute, and in an atmosphere maintained at 73° F and 50% relative humidity. Loads were applied parallel to the principal axis. Author

N64-32289 Toegepast Natuurwetenschappelijk Onderzoek, Delft (Netherlands) Central Labs.
MECHANICAL PROPERTIES OF HIGHLY FILLED ELASTOMERS III Technical Report No. 3
F. R. Schwarzl Jun. 1964 80 p
(Contracts N62558-3581; N62558-3884)
(CL/64/49; AD-602747)

Model substances were prepared of a polyurethane rubber filled with different amounts of various fractions of sodium chloride. Eight filler fractions were used with sizes between 1μ and 480μ. The amount of filler was varied between 0% and 50% by volume. An experimental method is described by which thermal expansion and bulk modulus of an isotropic material may be simultaneously determined as functions of temperature. The materials were investigated for thermal expansion and bulk modulus. All filled and unfilled samples show a glass–rubber transition, at which temperature the thermal expansion coefficient increases considerably and the bulk modulus decreases sharply. These temperatures do not depend on amount or size of filler. Author

N64-32451 Battelle Memorial Inst., Columbus, Ohio
ELASTOMERS FOR FUEL SYSTEMS CONTAINING MICROORGANISM-CONTROLLING ADDITIVES Quarterly Report, Jan. 1–Mar. 31, 1964
C. W. Cooper, H. T. Kemp, and R. M. Kell 31 Mar. 1964 40 p refs
(Contract AF 33(657)-9804)
(QR-5; AD-448633)

Twenty organic coatings for aluminum are under continuing exposure to sterile and microorganism-inoculated fuel–water systems. All show profuse growth in inoculated media. Six coatings for steel ground storage tanks and carriers are now also under exposure. Although there still is no visual evidence for attack of aluminum coatings, measurements of changes in electrical-resistance properties of these coatings indicate apparent greater degradation of materials exposed to microorganism-containing systems. Four biocides continue to appear effective as additives to a two-part polyurethane coating. Work is almost complete on room-temperature exposure of jet fuel system elastomers to a series of fuel–water biocide mixtures. Author

N64-32513 North American Aviation, Inc., Columbus, Ohio
INVESTIGATION OF ELECTRICALLY CURED STRUCTURAL ADHESIVES Second Interim Engineering Progress Report, 1 Apr.–30 Jun. 1964
John Tipton, H. B. Corson, and R. K. Newsome [1964] 35 p
(Contract AF 33(615)-1182)
(NA64H-377-2; AD-448634)

The major accomplishments of the program during this second reporting period have been the following: (1) specimen preparation and qualification tests; (2) power-requirement studies for various configurations and substrate materials; and (3) preliminary planning for fabrication and testing of prototype assemblies. Author

N64-32539 Office of Naval Research, London (Gt. Brit.)
THE DEPARTMENT OF GLASS TECHNOLOGY OF THE UNIVERSITY OF SHEFFIELD
Cyrus Klingsberg 31 Aug. 1964 10 p
(ONRL-48-64; AD-446500)

The paper reports building and academic improvements and gives a short description of most of the 28 graduate student research programs. These include studies on oxidation–reduction equilibria and optical absorption; nucleation and crystal growth; the mechanism of melting and refining; electrical properties of glass; fluorescence in glass; and electrons in glass. A.W.

N64-32579 General Dynamics/Fort Worth, Tex.
STUDY OF THE EFFECTS OF NUCLEAR RADIATION ON THE MECHANICAL PROPERTIES OF ACETAL RESINS DELRIN AND CELCON
E. G. Fritz 31 Mar. 1964 44 p refs
(Contract AF 33(657)-7201)
(NARF-63-18T; FZK-9-194; AD-603016)

Two commercial acetal resins (Delrin and Celcon) were exposed to reactor radiation at room temperature in air to five levels of absorbed dose: 3.07×10^8, 6.8×10^8, 1.53×10^9, 3.83×10^9, and 1.18×10^{10} ergs/gm(C). The tensile strength of both resins was found to decrease rapidly with increasing dose: 50% of the original value is reached at about 0.3 Gergs/gm(C) for Delrin and at about 0.75 Gergs/gm(C) for Celcon. At about 1 Gerg/gm(C), both materials had virtually lost their mechanical usefulness. The Shore-D hardness of the two resins was found to decrease exponentially with dose. Author

N64-32608 Optics Technology, Inc., Belmont, Calif.
INFRARED FIBER OPTICS INVESTIGATION Interim Engineering Report, 16 Aug.–15 Nov. 1963
Narinder S. Kapany Nov. 1963 61 p refs
(Contract AF 33(657)-11480)
(IER-2; AD-425492)

The results of the experimental evaluation of fused fiber optics components from IR 442 glass are presented. These results are discussed in detail for fused fiber optics plates, imaging cones, and single conical elements and, where applicable, conclusions are drawn on their performance potential in optical systems. Edge response measuring equipment has been designed and is under construction. A concentric crucible has been built and used for the production of coated arsenic-sulphur glass fibers, and these fibers are of sufficient quality for fabrication into fused components. Author

N64-32609 Douglas Aircraft Co., Inc., Long Beach, Calif.
SONIC FATIGUE DAMPING MATERIAL DEVELOPMENT Quarterly Report No. 3, 21 Dec. 1962–21 Mar. 1963
P. R. McGowan and J. M. Snider 1 Apr. 1963 55 p
(Contract NOw-62-0171-c)
(LB-31046, Suppl. 2; AD-403523)

Damping compounds were modified by the addition of aluminum or glass flakes of various sizes, and the effect, as

measured by the changed damping factor of a vibrating strip, was determined. The addition of either material improved the damping, but the ratio of one part flakes to two parts base appears most efficient. A temperature of −65° F had little effect, whereas an increase of temperature to 180° F greatly reduced the damping properties. Two-layer composite coatings were investigated and proved to be very effective but had a weight greater than the single coatings by 50% to 100%. Author

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see:* 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-31554* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
A HIGH-ORDER PERTURBATION THEORY USING RECTANGULAR COORDINATES
William Kizner Repr. from Progr. Astron. Aeron., v. 14, 1964 p 81–99 refs Presented at the AIAA Astrodyn. Conf., New Haven, 19–21 Aug. 1963
(Contract NAS7-100)
(JPL-TR-32-470; AIAA Paper 63-391)

This paper presents basically a method for approximating a system of nonlinear equations by a series of linear equations. The method has two parts. The first is similar to the Poisson method of developing a solution in terms of a small parameter, the difference being that Poisson used a Taylor series expansion, whereas a Runge–Kutta integration is used here. One advantage is that the method can be made of very high order without calculating complicated high-order derivatives. Another advantage is that generally the solution has a smaller error than the Poisson solution of the same order. The second part involves the refinement of the solution to the extent that it has negligible error. It is shown how either method can make use of any approximate solution to yield an exact solution. This method has been used to solve problems in nonlinear oscillations, and a simple version of it has been applied to the artificial satellite problem. Author

N64-31555 Wisconsin U., Madison
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G. Philip Johnson 8 Jun. 1964 4 p refs
(Grant Nonr(G)-00018-64)
(AD-602024) OTS: $1.00

The paper describes certain homomorphisms of one algebra B^1 to another. Work on homomorphisms of tensor products, primarily directed toward clarifying the B^2 case, is also discussed. It is concluded that such work can be used to yield results on the structure of rather general product algebras. Convolution semigroups are also given brief consideration. A.W.

N64-31623 Columbia U., New York, N.Y. School of Engineering
MARKOVIAN SEQUENTIAL DECISION PROCESSES
Cyrus Derman 1 Sep. 1963 20 p refs Presented at Symp. in Stochastic Processes in Math. Phys. and Eng., N.Y., Apr. 1963
(Contracts Nonr-266(55); NR-042-099)
(TR-20; AD-421612)

Optimal rules are derived for a dynamic stochastic system that is observed at times t = 0,1, ... and classified into one of a finite number of states 0, 1, ... ,L. After each observation the system is controlled by making one of a finite number of decisions 1, ... ,K. The possible rules are classified as C, denoting the class of all rules; C', denoting the subclass of rules for which

$$D_k(Y_0, \Delta_0, \ldots, Y_t = 1) = D_{ik}, \quad \begin{matrix} i = 0, \ldots, L; k = 1, \ldots, K \\ t = 0, 1, \ldots; \end{matrix}$$

and C'', denoting the subclass of C' for which $D_{ik} = 0$ or 1. Limit theorems are presented showing that attention can be restricted to rules in C' that satisfy certain given conditions. Linear programing formulations for obtaining the optimal rule are included. M.P.G.

N64-31637 Minneapolis-Honeywell Regulator Co., St. Petersburg, Fla. Aeronautical Div.
ELECTROSTATIC GYRO EVALUATION PROGRAM, GYRO TEST SPECIFICATIONS. VOLUME II. APPENDIX B. PROGRAM SPECIFICATION FOR THE STRAPPED-DOWN AESG DATA ANALYSIS SYSTEM
Robert Ritter et al Wright-Patterson AFB, Ohio, AE Avionics Lab., 15 Feb. 1964 308 p refs
(Contract AF 33(616)-8350)
(MH-AERO-61811-TR5; AL-TDR-64-34, Vol. II; AD-435463)

This data analysis problem involves reducing counter values (sensed by almost orthogonal pickoffs in the gyro case from lines etched on the gyro rotor) to a representation of the position of the gyro spin vector in a meaningful coordinate frame. A portion of test data (calibration period) is then used to compute by regression techniques the coefficients of the SD-AESG equations of motion for the gyro being considered. These equations are used to predict the gyro motion, which is in turn compared to the actual data to determine the drift rate or performance of the gyro. The various programs contained in the system are described. R.L.K.

N64-31639 Army Signal Missile Support Agency, White Sands Missile Range, N. Mex. Electro-Mechanical Labs.
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James S. Pappas and Patrick L. O'Dea Jul. 1964 36 p refs
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Algebraic concepts in dyadic form of eigenvalues and eigenvectors are developed. The operations are confined to a three-dimensional vector space, but extension to n-space is straightforward. Some preliminary steps show transformation of N-tuples of vectors, inner products, and introduction of dyadics. Examples of application to practical problems in missile-flight simulation are given. G.G.

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Kenneth Martin Larsen (Ph.D. Thesis) Aug. 1964 53 p refs
(Grant DA-ARO(D)-31-124-G499)
(AROD-1517-66; AD-446492)

This dissertation is mainly concerned with extremal properties of principal functions and modulus functions. By definition, a locally Euclidean n-space, or E-space, is an n-dimensional Riemannian manifold with a Euclidean metric. The extremal principal functions considered here are linear combinations of the principal functions p_0 and p_1. By definition, these functions in a regular region have a partial derivative of r^{2-n} as a singularity, r being the radius of spherical coordinates and $n \geq 3$. Moreover, the normal derivative of p_0 vanishes on the border, while p_1 is constant on the border. It is shown that $p_{\lambda\mu} = \mu p_0 + \lambda p_1$, μ and λ real, minimizes a functional. As a consequence, the existence of p_0, p_1 and the minimum property of $p_{\lambda\mu}$ are established for a noncompact

E-space. These results are used to obtain a reproducing property for $p_0 - p_1$. Author

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CAPACITY PROBLEMS IN LOCALLY EUCLIDEAN SPACES Technical Report No. 38
Robert Norman Meehan (Ph.D. Thesis) Jul. 1964 83 p
(Grant DA-ARO(D)-31-124-G499)
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This report describes an investigation of capacities and potential theory from the point of view of a classification theory of locally Euclidean n-spaces, which is similar to a scheme by which Riemann surfaces are classified, i.e., according to the existence of certain classes of harmonic functions on these spaces. The abstract theory of capacities of G. Choquet and the standard functions of potential theory such as the capacity function are utilized. Author

N64-31654 Johns Hopkins U., Baltimore, Md.
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V. K. A. M. Gugenheim Jul. 1964 16 p refs
(Contract DA-31-124-ARO(D)-171)
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Graded connected Hopf algebras with projected and locally finitely generated underlying modules were examined. In their "pointed" category, the notions of kernel and cokernel were defined. The extensions were exact sequences in the sense of the category. A near approach to the usual theory of Ext^n can be developed, but not all features of the classical theory can be transferred. G.G.

N64-31656 Michigan U., Ann Arbor Coll. of Literature, Science, and the Arts
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Yehoshafat Give'on Jun. 1964 56 p refs
(Contracts DA-ARO(D)-31-124-G433; DA-ARO(D)-31-124-G558; Nonr-1224(21))
(AROD-4049-6; AD-447530)

This report presents a theory of regular events that is based on the homomorphic characterization of regular events. The basic algebraic theory that underlies the approach taken is that of monoids (i.e., semigroups with identity element). Brief discussions of the Kleenean theory of regular events and the Rabin–Scotts theory of finite automata are included. Author

N64-31661 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.
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M. P. Jarnagin, Jr. and A. R. Di Donato 31 Jul. 1964 147 p refs
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ELECTROSTATIC GYRO EVALUATION PROGRAM: GYRO TEST SPECIFICATIONS. FOR THE GIMBALED AESG DATA ANALYSIS SYSTEM VOLUME III: APPENDIX C, PROGRAM SPECIFICATION
Robert Ritter Wright-Patterson AFB, Ohio. AF Avionics Lab., 5 Feb. 1964 282 p
(Contract AF 33(616)-8350)
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This volume contains the specifications and program listings for a digital computer program to analyze the gimbaled airborne electrostatic gyro. This data analysis problem involves comparing gyro motion equations with the actual gyro data to determine the performance of the gyro. Author

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N64-31743 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
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V. A. Zalgaller *In its* Herald of the Leningrad U. 28 Jul. 1964 p 1–7 refs (See N64-31742 23-23)

Convex polyhedrons for which each of the faces is a regular polygon are defined as regular-faced polyhedrons. Among these are included the five regular polyhedrons, prisms, antiprisms, and the 14 semiregular polyhedrons of Archimedes. The paper presents the finiteness of the number of some other regular-faced polyhedrons, such as those differing from prisms and antiprisms, and those that do not allow dissection by a plane into two other regular-faced polyhedrons. It is proved by examples that the number of convex polyhedrons with regular faces different from prisms and antiprisms is finite, and the number of those not capable of separation into two regular-faced parts by a plane is not less than 20. A.W.

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ON DIFFERENTIAL PROPERTIES OF BOUNDED GENERALIZED SOLUTIONS OF QUASI-LINEAR SYSTEMS OF THE VARIATIONAL TYPE
A. P. Oskolkov *In its* Herald of the Leningrad U. 28 Jul. 1964 p 8–32 ref (See N64-31742 23-23)

It is shown that bounded weak solutions of the so-called "divergent main part" class of quasi-linear equations systems are Hölder continuous if $p < n$ and not far from n $(n-1<p<n)$. A.W.

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V. A. Zalgaller *In its* Herald of the Leningrad U. 28 Jul. 1964 p 1–7 refs (See N64-31742 23-23)

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N64-31745 Air Force Systems Command Wright-Patterson AFB, Ohio Foreign Technology Div.
SEVERAL RESULTS ON THE PROPERTIES OF FUNCTIONS WHICH ARE DEFINED BY TRIGONOMETRIC SERIES WITH MONOTONIC DECREASING COEFFICIENTS
I. N. Pak *In its* Herald of the Leningrad U. 28 Jul. 1964 p 33–50 refs (See N64-31742 23-23)

The paper contains some new theorems of differentiability, signs and intervals of the monotony of functions, determined by trigonometrical series with coefficients that decrease monotonously up to zero. The theorems can be used to find the intervals of the constant signs, to find the approximate roots of the above functions, and to estimate the remainder of the trigonometrical series. Author

N64-31747 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON EXTERNAL REGIONS CONNECTED WITH ONE-SHEETED FUNCTIONS
Ya. S. Fel'dman *In its* Herald of the Leningrad U. 28 Jul. 1964 p 78–101 refs (See N64-31742 23-23)

Let S be a class of functions of the form

$$f(z)=z+a_2z^2+\ldots,$$

which are regular and univalent for $|z|<1$; d is a simple connected domain lying in the circle $|z|<1$ and bounded with a closed curve of Jordan, given by the parametric equations in polar coordinates: $\rho=\rho(t)$, $\varphi=\varphi(t)$, where $\rho(t)$ and $\varphi(t)$ are functions whose second derivatives are continuous. The equations of the boundary of the union and of the boundary of the intersection of all the images of the domain d are deduced. A similar problem is considered for the subclass of starlike functions of the class S. Author

N64-31773 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF HAMILTON–JACOBI IN VARIATION PROBLEMS WITH PARTIAL DERIVATIVES
K. A. Lur'ye 4 Sep. 1964 17 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 27, no. 2, 1963 p 255–264
(FTD-MT-64-224; AD-605406)

Problems with one unknown function of two independent variables are considered. Generalization to the case of many unknown functions or to more than two independent variables is stated to present no fundamental difficulties. Subjects covered include the canonical system corresponding to a variational problem, the field of a functional, and the method of Hamilton–Jacobi. As an example, the simplest problem of the vibration of an infinite string is considered. D.E.W.

N64-31816 RAND Corp., Santa Monica, Calif.
INTEGRAL EQUATIONS WITH DIFFERENCE KERNELS ON FINITE INTERVALS
A. Leonard and T. Mullikin Jun. 1964 19 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3942-PR; AD-601125)

A technique is presented for the solution of certain integral equations, on a finite interval of the real line, that arise in the theories of neutron transport, radiative transfer, gas dynamics, and electromagnetic wave refraction. The kernels in the equations studied are functions of the difference of the arguments and involve an exponential factor. Existence, uniqueness, and computational aspects are considered. Author

N64-31817 RAND Corp., Santa Monica, Calif.
NUMERICAL SOLUTION OF FUNCTIONAL EQUATIONS BY MEANS OF LAPLACE TRANSFORM—VI: STOCHASTIC TIME-OPTIMAL CONTROL
R. E. Bellman, R. E. Kalaba, and J. Lockett May 1964 21 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4119-PR; AD-600373)

The problem of transforming a system from its current state into a desired terminal state is treated in such a way as to maximize the probability of arriving within a prescribed time interval. The principal mathematical tool is the treatment of convolution integrals via Laplace transforms. This paper sketches the physical situation, derives the basic equations, discusses the numerical solution, and analyzes a special case, giving the FORTRAN program. Author

N64-31860 Joint Publications Research Service, Washington, D.C.
BINARY-DECIMAL COMMUTATORS FOR CALCULATING MACHINES
F. Ya. Galkin *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 60–67 ref (See N64-31851 23-15) OTS: $5.00

This article discusses the difficulties arising in the adaptation of decimal commutators to mechanical registers. These difficulties could be avoided with commutators utilizing binary codes for decimal numerals. Principle attention is focused on the methods of developing code systems that would give consideration to certain practical requirements. Author

N64-31879 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE PRESENTATION OF ELEMENTS OF SYSTEMS OF COLLINEATIONS OF THE SECOND AND THIRD DEGREE AS PRODUCTS OF TWO POLAR CORRESPONDENCES AND ON CERTAIN PROPERTIES OF COLLINEATIONS, CONNECTED WITH THIS QUESTION
V. A. Manevich 24 Jun. 1964 17 p refs Transl. into ENGLISH from Mat. Sb. (Moscow), v. 41(83), no. 2, 1957 p 221–230
(FTD-MT-63-317; AD-602399)

The validity and usefulness of presenting collinear correspondences on a plane in the form of the product of two correlations (polar correspondences) are demonstrated. It is shown that this concept can also be applied to the presentation of collineation in space. Certain questions associated with the presentation of elements of collineation systems of the second and third degree, in the form of the product of two polar correspondences, are considered. M.P.G.

N64-31880 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ABSOLUTE INVARIANCE AND INVARIANCE TO ϵ IN THE THEORY OF DIFFERENTIAL EQUATIONS, III
N. N. Luzin and P. I. Kuznetsov 30 Jun. 1964 7 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 80, no. 3, 1951 p 325–327
(FTD-MT-63-325; AD-602400)

The system of differential equations

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n &= f(t), \\ a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n &= 0, \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots & \\ a_{n1}x_1 + a_{n2}x_2 + \ldots + a_{nn}x_n &= 0, \end{aligned}$$

is considered where x_i are unknown functions of t; a_{ij} are polynomials with constant coefficients; D is the determinant of the system, $D = 0$; D_{11} is its minor, corresponding to a_{11}; and f(t) is an arbitrary analytic function holomorphic for $t = t_0$. Two basic theorems are proven: (1) If the criterion of absolute invariance for x_1 is satisfied for the system and if the system allows a solution with zero initial conditions for any analytic function f(t) holomorphic at t_0, then $x_1(t) = 0$ on any interval (a, b) of the holomorphism of f(t) containing the point t_0. (2) If the real parts of all roots α of the characteristic function $D(\alpha) = 0$ of the system are negative and if f(t) is an arbitrary function having all derivatives of order $\leq 2(n-1)$ on the interval $(-\infty, +\infty)$ continuous and contained between $-M$ and $+M$, then the system has one and only one limiting bounded solution on the interval $(-\infty, +\infty)$. Every other solution is asymptotic to it. Three special cases for f(t) are considered. E.W.

N64-31881 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A ONE-PARAMETER FAMILY OF STRATIFIABLE ORTHOGONAL PAIRS

N. I. Alekseyev 15 Jun. 1964 14 p Transl. into ENGLISH from Aviats. Inst., Tr. (Moscow), no. 61, 1956 p 20–29
(FTD-MT-63-334; AD-602402)

Basic equations are developed leading to the theorem that, with a congruence of common perpendiculars depending on four arbitrary functions of one argument, it is possible to connect a one-parameter family of stratifiable pairs that are symmetrical with respect to the center of the congruence of common perpendiculars and parallel to the main directions of the latter. M.P.G.

N64-31882 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

OPTIMAL CONTROL WITH RANDOM LOAD

N. N. Krasovskiy 24 Jun. 1964 17 p refs Transl. into ENGLISH from Sibirskiy Mat. Zh. (Moscow), v. 4, no. 3, 1963 p 622–631
(FTD-MT-64-20; AD-602403)

The problem of forming the manipulated variable of a controller is studied where some index of quality of the controlled process is at a minimum. This index is determined by a functional, derived from a limited section of the controlled motion. The considered system is subjected to a load, described as a Markov random of time function, and to interference. Optimal control is formed by measurement of realized values of the regulated quantity and the load. For a linear system carrying out a minimum of the quadratic functional, an obvious form of optimal control is given. The problem is solved by a method based on Lyapunov functions, taking into account the principles of dynamic programing. Author

N64-31897 Wisconsin U., Madison Mathematics Research Center

MILDLY NONLINEAR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS AND THEIR NUMERICAL SOLUTION, I

Seymour V. Parter May 1964 37 p refs
(Contract DA-11-022-ORD-2059)
(MRC-470; AD-603283)

The structure of the solutions of the Dirichlet problem for $(\Delta u = f(P, u))$, as well as the corresponding finite-difference equations is studied. This structure is then used to study the convergence of the solutions of the finite-difference equations to the solutions of the original problem. Author

N64-31899 Wisconsin U., Madison Mathematics Research Center

MILDLY NONLINEAR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS AND THEIR NUMERICAL SOULUTION, II

Donald Greenspan and Seymour V. Parter May 1964 42 p refs
(Contract DA-11-022-ORD-2059)
(MRC-474; AD-603291)

High-speed digital-computer methods are studied for obtaining solutions of difference equation analogs of mildly nonlinear elliptic boundary-value problems. The problem is formulated in terms of finding a vector X that satisfies $AX = -f(X) + Y$, where A is an irreducible M matrix, Y is a given vector, and f is a given function. Two general iteration techniques and related convergence theorems are explored. The methods and ideas also extend to a large class of ordinary differential equation boundary-value problems. Author

N64-31900 Wisconsin U., Madison Mathematics Research Center

ON PREDICTION IN THE BIVARIATE NORMAL DISTRIBUTION

Lionel Weiss May 1964 12 p refs
(Contract DA-11-022-ORD-2059)
(MRC-480; AD-603287)

The joint distribution of the random variables X, Y is bivariate normal with unknown parameters. The $(X_1, Y_1), \ldots, (X_{n+1}, Y_{n+1})$ are $n + 1$ independent observations on X, Y. A confidence interval for Y_{n+1} is constructed, based on the $2n+1$ random variables $X_1, Y_1, \ldots, X_n, Y_n, X_{n+1}$. Author

N64-31901 Wisconsin U., Madison Mathematics Research Center

MULTI-VALUED HOMOMORPHIC MAPPINGS AND SUBDIRECT COVERS OF PARTIAL ALGEBRAS

Michael Yoeli Jul. 1964 19 p refs
(Contract DA-11-022-ORD-2059)
(MRC-493; AD-605649)

A partial algebra is subdirectly covered, if it is represented as a homomorphic image of a subdirect product, subject to certain uniqueness restrictions. A complete characterization of such representations is obtained in this paper. As an important tool of this research, the concept of "weak homomorphism" is introduced. This is an extension of the usual concept of (partial) homomorphism to multivalued mappings. Well-known results on homomorphisms are generalized accordingly. The approach and methods of this research originated in a study of automata decompositions, and the results are applicable to the synthesis of automata (sequential machines). Author

N64-31902 Wisconsin U., Madison Mathematics Research Center

BAYESIAN ESTIMATION IN MULTIVARIATE ANALYSIS

Seymour Geisser Aug. 1964 19 p refs
(Contract DA-11-022-ORD-2059)
(MRC-503; AD-605653)

The Bayes approach to multivariate analysis is extended and given a more comprehensive treatment. Posterior joint and marginal densities are derived for vector means, linear combinations of means; simple and partial variances; simple, partial, and multiple correlation coefficients. Also discussed are the posterior distributions of the canonical correlations and of the principal components. For the general multivariate linear hypothesis, it is demonstrated that the joint Bayesian posterior region for the elements of the regression matrix is equivalent

to the usual confidence region for these parameters. The joint predictive density of a set of future observations generated by the linear hypothesis is obtained, thus making it possible to specify the probability that a set of future observations will be contained in a particular region. Author

N64-31913 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE CALCULATION OF EIGENVALUES OF THE LAPLACE OPERATOR BY THE METHOD OF GRIDS
D. P. Grossman 12 Jun. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v 106, no. 4, 1956 p 595–597
(FTD-MT-63-328; AD-602345)

A method is given for forming a polynomial for a small number of nodes of an approximating net-like region, with the approximate values being expressed through the nodes' roots. G.G.

N64-31914 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON DIFFERENTIABLE MAPPINGS
A. M. Rodnyinskiy 12 Jun. 1964 14 p refs Transl. into ENGLISH from Aviats. Inst., Tr. (Moscow), no. 61, 1956 p 58-66
(FTD-MT-63-332; AD-602348)

Proofs of three theorems on differentiable mappings are presented, together with the lemmas necessary for the proof of the theorems. Theorems 1 and 2 establish the behavior of a mapping near an individual point at which the Jacobian is not equal to zero. Theorem 3 asserts that if the Jacobian is positive (negative) at some point, then it is positive (negative) also on a set of positive size, and the image of this set is also a set of positive size. M.P.G.

N64-31917 RAND Corp., Santa Monica, Calif.
ON RANDOM WALKS WITH A REFLECTING BARRIER
Sidney C. Port Sep. 1963 22 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3597-1-PR; AD-420084)

The main result of this memorandum is to demonstrate that every recurrent random walk with the origin a reflecting barrier has the strong ratio limit property. This result is then used to obtain information about the solutions to the Wiener–Hopf equation and to study the first passage times to a half line for random walks on the entire line. Author

N64-31955 Wisconsin U., Madison Mathematics Research Center
LIMITING BEHAVIOR FOR AGE AND POSITION-DEPENDENT BRANCHING PROCESSES
Howard E. Conner Jun. 1964 47 p refs
(Contract DA-11-022-ORD-2059)
(MRC-481; AD-605638)

A model for the population transition probabilities for a branching process composed of particles diffusing in a finite interval is studied. The model is in general non-Markovian since it is assumed that the branching transformation probabilities for a particle depend on its age and position. The process is described by the random number $N_t(x)$ of particles in the interval I at time t that are generated by a single particle initially at the point x in I. By considering $N_t(x)$ as a regenerative process with respect to the random age and position of the initial particle when it is transformed, a functional equation for the generating function for $N_t(x)$ is developed. This functional equation is the basis for the study of the population probabilities $P(N_t(x) = n)$, $n = 0,1,2,....$, as function of x in I and t in $[0,\infty]$. Author

N64-31956 Wisconsin U., Madison Mathematics Research Center
NUMERICAL STUDIES OF THE NAVIER-STOKES EQUATIONS
D. Greenspan, P. C. Jain, R. Manohar, B. Noble, and A. Sakurai May 1964 58 p refs
(Contract DA-11-022-ORD-2059)
(MRC-482; AD-605639)

This report summarizes work on the numerical solution of the time-dependent Navier–Stokes equations governing the flow of an incompressible viscous fluid. Two problems are considered in connection with flow in rectangular regions, one involving periodic boundary conditions, the other involving fixed and moving walls. In each case two methods of approach are investigated, one using finite differences, the other using Fourier series in the space variables. Author

N64-31957 Wisconsin U., Madison Mathematics Research Center
POSITIVE OPERATORS AND AN INERTIA THEOREM
Hans Schneider May 1964 16 p refs
(Contract DA-11-022-ORD-2059)
(MRC-484; AD-605641)

A generalization of the theorem of Perron–Frobenius is used to prove an inertia theorem, which contains Lyapunov's theorem and Stein's theorem as special cases. It is pointed out that there is a close relation between the inertia theorem and known results on M-matrices. Author

N64-31959 Wisconsin U., Madison Mathematics Research Center
FURTHER PROPERTIES OF A SEQUENTIAL TEST OF FIT
Lionel Weiss May 1964 15 p refs
(Contract DA-11-022-ORD-2059)
(MRC-486; AD-605643)

In earlier papers, a sequential test of fit was proposed and examined. In the present paper, the expected sample size under alternatives to the null hypothesis is investigated, and a modification of the test is proposed that is more easily compared to other tests. Author

N64-31961 Wisconsin U., Madison Mathematics Research Center
GRADUATED LOGARITHMIC FIELDS AND STABILITY
Walter Strodt Jun. 1964 59 p refs
(Contract DA-11-022-ORD-2059)
(MRC-489; AD-605646)

The concept of a graduated logarithmic field is defined and developed. A graduated logarithmic field is a graduated field endowed with a differentiation operator D and with logarithms, i.e., solutions of the equations $D\xi_0 = 1$, $\xi_0\ D\xi_1 = 1$, $\xi_0\xi_1 D\xi_2 = 1,...$; the operator D is postulated to have a certain stability with respect to the partial order in the underlying graduated field. In this abstract setting, the algorithms of the principal monomial and of approximate factorization are carried out in a greatly generalized form and given new interpretations in terms of the concept of stability. Author

N64-31962 Wisconsin U., Madison Mathematics Research Center
ON NON-NEGATIVE DIFFERENCE ANALOGUES OF ELLIPTIC DIFFERENTIAL EQUATIONS
D. Greenspan and P. C. Jain Jun. 1964 16 p refs
(Contract DA-11-022-ORD-2059)
(MRC-490; AD-605647)

Let L be the elliptic differential operator defined on region R by $L[u(x, y)] \equiv u_{xx} + 2b(x, y)u_{xy} + c(x, y)u_{yy}$, $b \not\equiv 0$, where b(x, y) and c(x, y) are continuous and bounded on R. At any point $(x, y) \in R$, the ellipticity condition alone is shown to imply the existence of a nine-point difference operator analog L_h of L which is of nonnegative type. Moreover, L_h is given constructively. For numerical considerations in general it is shown to be sufficient that the following inequality be valid:

$$\sup_{(x,y)\in R} |b(x, y)| < \inf_{(x,y)\in R} \left[\frac{c(x, y)}{|b(x, y)|}\right]$$

Necessary and sufficient conditions are described for the existence of nonnegative analogs that use fewer than nine points, and the corresponding analogs are given constructively. Also, several examples are given where the above results are applied. Author

N64-31963 Wisconsin U., Madison Mathematics Research Center

NEWTON'S METHOD FOR CHARACTERISTIC VALUE-VECTOR PROBLEMS

P. M. Anselone and L. B. Rall Jun. 1964 25 p refs
(Contract DA-11-022-ORD-2059)
(MRC-492; AD-605648)

A general characteristic value–vector problem for linear operators in real Banach spaces is formulated as a nonlinear equation in the product space of the given space and the real scalar field. Newton's method and a modified form of Newton's method are investigated for the solution of this equation from the standpoints of theory and technique. An application is given to the case that the operator considered is a perturbation of one with known characteristic values and vectors. A method is presented for extending the results for real spaces to complex spaces. Author

N64-31964 Wisconsin U., Madison Mathematics Research Center

QUASILINEAR UNIFORMLY ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS AND DIFFERENCE EQUATIONS

G. T. Mc Allister Jul. 1964 15 p refs
(Contract DA-11-022-ORD-2059)
(MRC-494; AD-605650)

In this paper a difference method for the quasilinear uniformly elliptic partial differential equation

$$a(x,y,u,u_x,u_y)u_{xx} + 2b(x,y,u,u_x,u_y)u_{xy} + c(x,y,u,u_x,u_y)u_{yy} = 0$$

is studied. Assuming that the coefficients are Lipschitz functions of their arguments, that a and c satisfy relations of the form

$$K_0 \geq f(x,y,u,u_x,u_y) \geq \mu > 0,$$

uniformly in the arguments, and that

$$\mu \geq 2|b|,$$

it is shown that the difference problem has a solution and that it converges uniformly to the continuous solution. Author

N64-31965 Wisconsin U., Madison Mathematics Research Center

STABILITY, PERIODICITY AND ALMOST PERIODICITY OF SOLUTIONS OF NONLINEAR DIFFERENTIAL EQUATIONS IN BANACH SPACES

C. T. Taam Jul. 1964 56 p refs
(Contract DA-11-022-ORD-2059)
(MRC-496; AD-605651)

Conditions for the existence and stability of bounded solutions, periodic solutions, and almost periodic solutions of certain nonlinear differential equations in Banach spaces are obtained. The dependence of these solutions on a parameter is also investigated from the point of view of continuity, measurability, and summability. Author

N64-31967 Dunlap and Associates, Inc., Darien, Conn.

MATHEMATICAL PROGRAMMING TECHNIQUES FOR INFORMATION SYSTEM DESIGN

Ugo, O. Gagliardi, C. G. Ying, and L. G. Holt Bedford, Mass., AFCRL, Jul. 1964 88 p refs
(Contract AF 19(628)-2830)
(DRD-64-112; ESD-TDR-64-530; AD-605826)

The problem of establishing the effectiveness of an information system is considered. An effectiveness measure suggested by recent development in statistical decision theory is presented. Sample evaluations or system designs are used to illustrate the adoption of such a measure, which allows selecting the parameters of the system in a manner consistent with the user preference. Author

N64-31971 RAND Corp., Santa Monica, Calif.

NUMERICAL METHODS AND PROGRAM DESCRIPTION FOR THE INVERSE PROBLEM OF LINEARIZED, FULLY-CAVITATING, HYDROFOIL THEORY

R. S. Grote Sep. 1964 205 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3563-PR; AD-606062)

The computer routines have been devised to calculate the profile shapes for two design methods and an off-design consideration of the problem. The present report briefly discusses each of the three methods, and proceeds to detailed presentations of the corresponding subroutines. The three methods encompass the cases of shockless entry, nosesingularity, and the off-design calculations. Author

N64-31974 RAND Corp., Santa Monica, Calif.

NUMERICAL SOLUTION OF FUNCTIONAL EQUATIONS BY MEANS OF LAPLACE TRANSFORM—IV: NONLINEAR EQUATIONS

R. E. Bellman, R. E. Kalaba, and J. Lockett May 1964 18 p refs
(Grant NIH GM-09608-02)
(RM-4088-NIH; AD-600161)

The effectiveness of using numerical inversion of the Laplace transform, coupled with successive approximations, in nonlinear functional equations is demonstrated. A nonlinear differential equation, a nonlinear differential-difference equation, and a nonlinear diffusion equation are employed, and convergence aspects are considered. G.G.

N64-31976 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE THEORY OF THE EQUATION $y(\partial^2 z/\partial x^2) + (\partial^2 z/\partial y^2) = 0$

F. I. Frankl' 27 Aug. 1964 42 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 10, 1946 p 135–166
(FTD-MT-63-347; AD-605755)

The solution is given for two boundary-value problems for the equation $y\,\partial^2 z/\partial x^2 + \partial^2 z/\partial y^2 = 0$ in the domain of the upper half-plane, adjoining a segment of the axis of abscissas. The solution is obtained by means of a double layer; several limitations are removed, which in other works were put on the form of the domain boundary. Author

N64-32023 Brown U., Providence, R.I.
EXTENSIONS TO THEORY OF TIME-SERIES ANALYSIS
Quarterly Report, 1 Feb.–30 Apr. 1964
Walter Freiberger [1964] 3 p
(Contract DA-36-039-SC-87222)
(QR-7; AD-601741) OTS: $1.00

Two abstracts are presented of two papers issued in this quarter under title of "The Analysis and Prediction of Meteorological Fields" and "Statistical Methods for the Extrapolation of Meteorological Fields." A.W.

N64-32035 Illinois U., Urbana
STRONG RIESZ SUMMABILITY OF INTEGRALS
R. D. Dixon 1963 22 p refs
(Contract Nonr-1834(18))
(AD-420953)

The theory of strong Riesz limits for certain functions with limited discontinuities is developed, and then the theory is applied to a class of integrals associated with Dirichlet series in order to obtain information about the Carlson ν function associated with the Dirichlet series. Author

N64-32049 Purdue U., Lafayette, Ind. School of Electrical Engineering
PATTERN RECOGNITION AND MACHINE LEARNING USING SEQUENTIAL DECISION APPROACH
K. S. Fu and C. H. Chen Apr. 1964 80 p refs
(NSF GP-2183)
(TR-EE64-9)

The fact that the sequential decision procedures (sequential probability ratio test and generalized sequential probability ratio test) can reduce the average risk in a monotonic fashion implies the gradual improvement of system performance during operation. The feature selection problem is also considered, and both receptor (feature-extraction) and categorizer (decision) parts are treated as a whole. Before terminal decision is made, a feedback loop requests the categorizer to continue taking observation and properly adjust the stopping thresholds. At the same time, another feedback loop feeds back the outcome of recognitions thus far obtained to the receptor for selecting a proper feature for next observation. Using the proposed feedback scheme, the overall system performance has shown significant improvement during operation. Author

N64-32081 Lincoln Lab., Mass. Inst. of Tech., Lexington
THE DOUBLY NON-CENTRAL F-DISTRIBUTION EXPRESSED IN FINITE TERMS
Robert Price 13 Sep. 1963 57 p refs
(Contract AF 19(628)-500)
(AFESD-TDR-63-556; AD-420434)

Explicit and exact formulas are provided for the doubly noncentral F-distribution where the numbers of degrees of freedom of the chi-square variates need not be equal, but are restricted to be either both even or both odd. The formula for the even-even case is considerably simpler in structure than that for the odd-odd case, although the former involves Bessel functions whereas the latter contains error-functions. Interpolation from the even-even formula is suggested for high-degree numbers in the odd-odd case and is the only alternative to literal numerical integration for mixed odd–even cases. A byproduct of the technique used in this analysis is an alternative, explicit, and finite-term formula for the singly noncentral F-distribution when both χ_1^2 and χ_2^2 have an odd number of degrees of freedom. M.P.G.

N64-32089 RAND Corp., Santa Monica, Calif.
THE EQUIVALENCE OF SOME NECESSARY CONDITIONS FOR OPTIMAL CONTROL IN PROBLEMS WITH BOUNDED STATE VARIABLES
Leonard D. Berkovitz and Stuart E. Dreyfus Oct. 1963 24 p refs
(Contract AF 49(638)-700)
(RM-3871-PR; AD-421877)

The problem of optimal control is considered, as studied separately by Gamkrelidze, Berkovitz, and Dreyfus, wherein a constraint is placed on the state variables. Dreyfus asserts that a certain specified condition holding along a boundary of state space and relating (n-1) quantities is necessary for optimality. Furthermore, he relates these (n-1) quantities to certain other quantities at junction points of an interior segment of a trajectory with the boundary. Gamkrelidze and Berkovitz distinguish n quantities and give relationships that they must satisfy on the boundary and at junction points. This memorandum shows that Dreyfus' (n-1) variables can be expressed in terms of the Gamkrelidze–Berkovitz n variables in such a way that the two different representations of the boundary and junction point conditions become identical. Author

N64-32111 Applied Logic Corp., Princeton, N.J.
TOWARD SEMI-AUTOMATED MATHEMATICS: THE LANGUAGE AND LOGIC OF SAM III Scientific Report No. 2
James H. Bennett, William B. Easton, James R. Guard, and Thomas H. Mott, Jr. 1 May 1964 90 p refs
(Contract AF 19(628)-3250)
(AFCRL 64-563; AD-606308)

The first two programs consist of a source language, closely resembling the language of mathematical logic, and an associated machine language processor for specifying exact procedure for building proofs in elementary natural deductive and first-order axiom systems of mathematics, such as the propositional calculus, elementary group theory, and set theory. The third program, dubbed Sam III, includes the salient features of SAM I and SAM II but, in addition, contains provisions for the introduction of quantification theory, inference by substitution for variables of finite, mixed types, automatic application of rules of propositional and equality inference, and other important features. Natural deduction is retained as the basic method for carrying out proofs in the system. Author

N64-32112 Michigan U., Ann Arbor Radiation Lab.
ITERATIVE SOLUTIONS OF THE HELMHOLTZ EQUATION
R. E. Kleinman Aug. 1964 68 p refs *Its* Rept. No. 3648-7-T
(Contract AF 19(604)-6655)
(AFCRL-64-684; AD-606630)

The present work describes a method whereby the solution of the general Dirichlet problem for the three-dimensional Helmholtz equation is explicitly expressed in terms of the Green's function for the corresponding potential problem. A new integral equation for the scattered field is derived whose kernel is the potential Green's function for the surface instead of the free space Green's function for the Helmholtz equation. Despite the fact that the integral operates over all space, rather than just the scattering surface, and is really an integro-differential operator, it is still possible to solve the equation iteratively in a standard Neumann expansion, which has a nonzero radius of convergence and may be interpreted as a partial summation of the low-frequency expansion. The results are valid for complex as well as real values of wave number, k, with no restriction on the sign of the imaginary part, provided k is sufficiently small in absolute value. Author

N64-32145 Radio Corp. of America, Burlington, Mass. Aerospace Systems Div.
MODULAR ARITHMETIC COMPUTER RESEARCH Final Report
Wright-Patterson AFB, Ohio, AF Avionics Lab., 1 Apr. 1964 89 p refs
(Contract AF 33(657)-7987)
(AL-TDR-64-86; AD-606652)

The design of a general-purpose digital computer that performs arithmetic operations in the residue number systems is described. The residue number system provides a solution to a prime problem in the design of an arithmetic unit, obtaining a fast multiply operation at a reasonable cost. In the implemented design, the execution times of addition, subtraction, and multiplication are the same. The arithmetic unit is implemented with transistor logic circuits based on the use of directly coupled complementary transistors, and contains about 1500 transistors for three registers, the decoders, matrices, encoders, and special control circuits. The equivalent word length of the arithmetic unit is slightly in excess of 15 binary digits. Author

N64-32158 Joint Publications Research Service, Washington, D.C.
THEORY OF GAMES
V. I. Krinskiy and V. A. Ponomarev 13 Oct. 1964 9 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 9, no. 3, 1964 p 372-375
(JPRS-26880; TT-64-51137) OTS: $1.00

This article belongs to a series of works devoted to modeling of the simplest forms of behavior with the help of finite automata. Models of this kind are useful for the study of a number of questions connected with the work of complicated physiological systems, such as interaction of nervous center, control of arbitrary movements, etc. The important role that circumstance plays, besides that of the collective behavior of simply arranged automatic machines, is frequently expedient under conditions relative to the complicated medium. The language of theory of games, utilized here for describing the interaction of automatic machines, is not its only use. However, with a narrowing of the class of considered forms of behavior, this language leads to the construction of a series of interesting models. Author

N64-32168 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOLUTION OF THE FIRST BOUNDARY VALUE PROBLEM FOR ELLIPTICAL EQUATIONS BY MEANS OF NETS
D. P. Grossman 11 Jun. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 106, no. 5, 1956 p 770-772
(FTD-MT-63-329; AD-602344)

The method of nets reduces the approximate solution of the first boundary-value problem to the solution of a system of linear algebraic equations. Simple iterations and Seidel iterations for this system of equations converge. The assumption was stated that the Seidel iterations must converge faster than simple iterations. By direct calculation of corresponding eigenvalues, it was established in 1950 that for the two dimensional Laplace equation in the case of a rectangular region with some numeration of nodes, Seidel iterations converge two times faster than simple iterations. A number of theorems are formulated and presented that greatly generalize this result. Presented definitions and theorems are transferred to the case of a net composed from regular hexagons, and also to the case of the solution of the first boundary-value problem for a given type of equation in n-dimensional space with the help of a net composed of n-dimensional cubes. Proofs of theorems are based largely on the method of solution of a given type of determinants. D.E.W.

N64-32190 California Inst. of Tech., Pasadena Karman Lab. of Fluid Dynamics and Jet Propulsion
A COMPUTER METHOD FOR CALCULATION OF THE COMPLETE AND INCOMPLETE ELLIPTIC INTEGRALS OF THE THIRD KIND
D. K. Ai and Z. L. Harrison Feb. 1964 39 p refs
(Contract Nonr-220(43))
(E-110.3; AD-437207)

Numerical approximations and a Fortran IV program are given for the computer calculation of the complete and incomplete elliptic integrals of the third kind. In its present form results are limited to six decimal places, but the method is valid for all values of amplitude ϕ, modulus k, and real values of the parameter α^2. For the purpose of completeness, adaptations of other programs for complete and incomplete elliptic integrals of the first and second kind are also presented. Author

N64-32195 Uppsala U. (Sweden) Quantum Chemistry Group
REDUCTION OF KROECKER PRODUCTS OF SPACE GROUP REPRESENTATIONS IN THE FRAME-WORK OF LITTLE GROUP THEORY Scientific Report No. II
I. V. V. Raghavacharyulu 1 Apr. 1964 28 p refs *Its* Prepr. No. 116
(Contract AF 61(052)-701)
(ARL-64-183; AD-603556)

A general method for the reduction of the representations of space groups is discussed, making use of their allowable representations. Given any representation this method depends on finding some appropriate representations of suitable groups of wave vectors of the space group, which are then decomposed into different allowable representations of them. As the irreducible representations of the space group are uniquely defined by its allowable representations, by this procedure the complete reduction of the given representation is effected. Author

N64-32296 Columbia U., New York, N.Y.
OCCUPATION TIME PROBLEMS IN THE THEORY OF QUEUES
Lajos Takacs 15 Apr. 1964 30 p refs
(Contract Nonr-266(59))
(CU-44-64-Nonr-266(59)MS; AD-605621)

A single-server queue is considered. Discussed is the problem of finding the distribution of the total occupation time of the server in the time interval (O,t) and the distribution of the number of services among the first n services that are not preceded by an idle period. The results are used in the theory of dams. Author

N64-32303 Aerospace Corp., El Segundo, Calif.
THE DYNAMIC STABILITY OF ELASTIC SYSTEMS: VOLUME IV.
V. V. Bolotin 10 May 1963 108 p refs
(Contract AF 04(695)-169)
(TDR-169(3560-30)TR-2, Vol. 4; SSD-TDR-62-154, Vol. 4; AD-442727)

The elements of the matrix operations and of the theory of linear integral equations are discussed. Differential equations for boundaries of the dynamic stability of rods are also discussed. Author

N64-32389 Aeronutronic, Newport Beach, Calif.
ACQUISITION PROGRAM FOR TRACKING AND SURVEILLANCE OF EARTH SATELLITES
A. P. Callanan and G. Torrero Oct. 1963 78 p
(Contract AF 19(628)-562)
(U-1854; ESD-TDR-63-615; AD-421692)

A computer program has been developed to calculate acquisition coordinates of earth satellites for tracking sensors and for fixed beam surveillance sensors. In the former case, acquisition coordinates, including the time of closest approach, are generated for all observable passes of the requested satellites. For surveillance sensors, the program computes the time and coordinates of beam penetrations of all designated satellites. This computer program may be used to simulate sensor–satellite patterns or to generate calculations for real satellites and existing sensors. Author

N64-32432* Seton Hall U., South Orange, N.J.
THE REGULARIZED EXPLICIT SOLUTION OF THE ANALYTIC N-BODY PROBLEM
L. M. Rauch Washington, NASA, Oct. 1964 32 p refs
(Grant NsG-413)
(NASA-CR-123) OTS: $1.00

The regularized N-body problem is resolved in explicit form by the introduction of a pseudo-time parameter in the form of a Sundman and Levi–Civita transformation. The solution consists of two phases, namely, by the formal representation of the solution by a pseudo-time series and by the analytical justification of the process. A brief third part is added as a directive in the essential mode of numerization of the problem. Author

N64-32456 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPECIAL REPRESENTATION OF FUNCTIONS OF MANY VARIABLES
A. V. Ignat'ev 30 Mar. 1964 14 p refs Transl. into ENGLISH from Uch. Zap., Mosk. Gos. Univ., Matematika. (Moscow), v. 9, no. 186, 1959 p 235–244
(FTD-MT-63-302; AD-449213)

An elementary method is given for representation of the function f $(x_1, x_2, \ldots, x_n)$ that is useful for comparatively small restrictions. An example is also given of the application of such a representation to the solution of the Cauchy problem for systems of linear equations in partial derivatives with constant coefficients of the hyperbolic type. A.W.

N64-32464 General Electric Co., Santa Barbara, Calif.
WEAPONS PHENOMENOLOGY CODE (WEPH II). VOLUME 3: INVESTIGATION OF EFFECTS OF NUCLEAR DETONATIONS ON PROPAGATION OF ELECTROMAGNETIC WAVES Annual Report
C. Luehr and R. Bogusch 31 Mar. 1964 232 p
(Contract AF 19(628)-207; ARPA Order 6-62; Proj. Defender)
(AFCRL-64-196(3); R64TMP-8-(3); AD-448779)

A revised Weapons Effects Phenomenology computer program (WEPH II) is presented that includes the effects of nuclear data obtained since the original program was written. The changes include revised reaction rate coefficients in the detonation equations; new expressions for the radius, rise, and temperature of low-altitude fireballs; more accurate methods of computing the quasi-equilibrium and the transient-electron concentrations; inclusion of an ionosphere ionization source in the electron concentration calculations; and revised coding details to reduce running time and storage requirements. WEPH II is written entirely in FORTRAN. Equations, flow diagrams, instructions, and optional subroutines are given. M.P.G.

N64-32468 Bettis Atomic Power Lab., Pittsburgh, Pa.
RECAP-3—A MONTE CARLO PROGRAM FOR ESTIMATING EPITHERMAL CAPTURE RATES IN RECTANGULAR OR 60° PARALLELOGRAM GEOMETRY
N. R. Candelore and R. C. Gast Mar. 1964 37 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-437) OTS: $0.75

The calculation of epithermal capture rates in a rectangular or 60° parallelogram geometry system is described in a FORTRAN program. The program will permit 400 regions; 25 different compositions; 10 nuclides, including five resonance absorbers; symmetry, rotational, and a combination of symmetry and rotational boundary conditions. The resonance capture probabilities are calculated using a Σ_a/Σ_T estimator. Smooth and resonance captures are edited separately. All cross section information required is obtained from a magnetic tape of doppler broadened cross sections. Author

N64-32474* Martin Co., Baltimore, Md. Rias Div.
EQUIVALENCE OF DIFFERENTIAL SYSTEMS
Courtney Coleman Jun. 1964 39 p refs
(Contracts NASw-845; AF 49(638)-1242; Nonr-3693(00))
(AD-448771)

Theorems and definitions dealing with several kinds of equivalence are considered. Previous work (Markus) on the linear equivalence of quadratic systems is generalized to all homogeneous polynomial systems. Other work (Nemytskii) on the global trajectory equivalence of planar homogeneous dynamical systems is corrected. These corrected results are applied to the problem of local trajectory equivalence near a critical point of a planar differential system and its (nonlinear) system of the first approximation. It is shown that all asymptotically stable critical points are locally trajectory equivalent, and the notion of trajectory equivalence is reduced to that of manifold equivalence. P.V.E.

N64-32507 Michigan U., Ann Arbor Cooley Electronics Lab.
SCHEDULING WITH RANDOM ARRIVALS AND LINEAR LOSS FUNCTIONS Technical Report No. 144
D. W. Fife Apr. 1964 19 p refs
(Contract AF 30(602)-2661)
(Rept.-04967-2-T; AD-449200)

The problem under consideration involves scheduling of the processing of an initial queue of jobs and subsequent Poisson arrivals on a single processor. Each job to be processed incurs a loss that increases linearly with its waiting time. The scheduling algorithm is sought, which minimizes the average rate of expected loss over infinite time. It is shown that if statistical equilibrium exists for the total loss of an individual arrival, the optimal schedule minimizes the expected total loss of a single arrival, and is given by the scheduling rule that applies when there are no additional arrivals. Author

N64-32534 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON SOME EXTENSIONS OF A FEHLBERG TRANSFORMATION
A. Cotiu 20 Aug. 1964 16 p refs Transl. into ENGLISH from Buletinul Stiint. al Inst. Politehnic din Cluj (Rumania), no. 4, 1961 p 45–54
(RSIC-249; AD-605383)

Generalizing the property involved in the Runge–Kutta method, an operation was shown permitting the construction of any order of accuracy for the numerical integration of differential equations of the first order. In the present paper, a class of procedures of the fourth order of accuracy, a fifth-order

procedure, and a class of procedures of the sixth order of accuracy are shown for numerically integrating differential equations of the first order. A.W.

N64-32535 Massachusetts Inst. of Tech., Cambridge Operations Research Center
A MATHEMATICAL ANALYSIS OF COMPUTER TIME-SHARING SYSTEMS. FUNDAMENTAL INVESTIGATIONS IN METHODS OF OPERATIONS RESEARCH Interim Technical Report No. 20
Nitin Ratilal Patel (M.S. Thesis) Jul. 1964 51 p refs
(Contract Nonr-4102(01); Grant DA-ARO(D)-31-124-G158)
(AROD-9608-37; AD-605825)

Two time-sharing systems were analyzed for the expected waits of requests—the Round-Robin and the Dynamic-Priority Multiple-Level systems. The Round-Robin is very complex in all its generality; however, with the aid of a realistic simplifying assumption the desired expected waits were calculated. The Round-Robin under worst conditions (i.e., full load) was analyzed rigorously. The results of the Dynamic-Priority Multiple-Level system were complex in general, but were derived generally nevertheless. Specialization of these results should simplify them somewhat. Author

N64-32577 Navy Electronics Lab., San Diego, Calif.
TABLES FOR THE SEQUENTIAL BINOMIAL TEST WITH DETECTION AND GENERAL APPLICATIONS Research Report, Jan. 1962–Aug. 1963
R. A. Worley 3 Dec. 1963 558 p refs
(NEL-1202; AD-602929) OTS: $13.97

Statistics that predict the behavior of a binomial sequential test (moments and distribution of sample size and error probabilities) are tabulated for a variety of parameter combinations. Some of these statistics are plotted. Graphs and simple estimation methods are given so that a suitable sequential test may be quickly constructed. Binomial quantization of a continuous variable for a probability ratio test is considered; here the emphasis is on detection of signals in noise. The quantization levels that minimize sample size have been determined for several common underlying distributions. The behavior of functions that statistically describe test performance is discussed in relation to interpolation. Author

N64-32615 Brown U., Providence, R. I. Div. of Applied Mathematics
ADDITIVE FUNCTIONALS
R. V. Chacon and N. Friedman Jun. 1964 27 p refs
(Contract Nonr-562(10))
(TR-93; AD-603438)

Proof is derived that additive functionals that are not linear can best be represented in terms of linear functionals by obtaining the analog of the Riesz theorem. M.P.G.

N64-32619 Westinghouse Electric Co., Baltimore, Md. Aerospace Div.
PARALLEL NETWORK COMPUTER (SOLOMON) Final Report
Griffiss AFB, N.Y., RADC, Aug. 1964 143 p
(Contract AF 30(602)-2724)
(Rept.-406A2; RADC-TDR-63-261, Vol. II, Pt. II; AD-606577)

This volume describes the functional capabilities of SOLOMON from a programer's point of view. General programing information along with a functional description of each unit and a detailed description of each available instruction are provided. The instruction list includes the PE network instructions, the network control unit, unit control instruction, the network control unit arithmetic instruction, and the input–output instruction. Author

N64-32638* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS BY POWER SERIES EXPANSIONS, ILLUSTRATED BY PHYSICAL EXAMPLES
Erwin Fehlberg Washington, NASA, Oct. 1964 15 p refs
(NASA-TN-D-2356) OTS: $0.50

Some general situations are discussed, where a power series expansion (with coefficients obtained by recurrence formulas) has advantages over other integration procedures. Two examples are presented—the restricted problem of three bodies, and the motion of an electron in the field of a magnetic dipole. In these examples, the power series expansion requires only about 15% to 20% of the computer time required by the Runge–Kutta–Nyström method, both methods yielding results of the same accuracy. Author

N64-32648 General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
HALF FUNCTION: A TECHNIQUE FOR STORING TWO FLOATING POINT NUMBERS IN A 36-BIT COMPUTER WORD. NUCLEAR PULSE PROPULSION CONCEPT
L. L. Reed 12 Dec. 1963 12 p
(Contract AF 29(601)-6214)
(GAMD-4805; AD-449770)

A technique for storing two floating-point numbers in one machine word is described. Unlike other methods, this technique increases the number of significant bits that can normally be stored in half a machine word by imposing a limit on the range of numbers stored, and also by forcing these numbers to be positive. Two complementary FAP subroutines that store and retrieve the desired floating-point numbers are given, as well as the call statements for using these subroutines in FORTRAN. M.P.G.

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-31372 Howell (W.E.) Associates, Inc., Lexington, Mass.
A STUDY OF MIDDLE CLOUD WAVE PATTERNS Final Report
Manuel E. López and Sigurd N. Ronning 31 May 1964 149 p refs
(Contract AF 19(628)-306)
(AFCRL-64-465; AD-605416)

A catalog of stereophotographs of middle-cloud wave patterns has been compiled. A study is made of the relations between the mass velocity and the phase velocity of the waves, the wind shear, and the various angles between these vectors. An almost random distribution of the angles between phase and mass velocities is found. A tendency is found for the phase velocity to be in the same direction as the wind shear; and this tendency is significantly stronger in the case of retrogressive waves (waves moving slower than the component of the average wind along the direction of wave travel). A comparison of wavelengths, computed by assuming that the waves form as short gravitational waves at the interface of two layers, with the actual wavelengths shows good correspondence. The altitude of waves with wavelengths greater than 3 km also correlates

well with the lowest altitude at which a minimum of Scorer's parameter occurs, lending support to the notion that many of these gravitational waves originate from lee-wave impulses. Author

N64-31451* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE, PRESSURE, DENSITY, AND WIND MEASUREMENTS WITH THE ROCKET GRENADE EXPERIMENT, 1960–1963
W. Smith, L. Katchen, P. Sacher, P. Swartz, and J. Theon Washington, NASA, Oct. 1964 50 p refs
(NASA-TR-R-211) OTS: $1.25

Complete data from 28 rocket grenade experiment at Wallops Island, Virginia, and Fort Churchill, Canada, are presented. Pressures, temperatures, densities, and winds have been derived directly from the recorded times of explosions and sound arrivals; but no attempt has been made to analyze the meteorological significance of these measurements. Error analyses on 16 of the Wallops experiments are also included. Author

N64-31600 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.
AEROBEE AD 3.355 Meteorlogical Data Report
Marjorie Mc Lardie Hoidale Jun. 1964 42 p
(ERDA-150; AD-447826)

Meteorological data gathered for the launching of Aerobee AD 3.355 are presented along with calculated ballistic data. Author

N64-31657 Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.
THE OCEAN BREEZE AND DRY GULCH DIFFUSION PROGRAMS, VOLUME II
Duane A. Haugen and John H. Taylor, ed. Dec. 1963 110 p refs
(AFCRL-63-791(II); AD-427687)

This volume is devoted to analyses of the data to develop diffusion prediction equations, description of the Weather Information Network Display (WIND) systems, recommendations for operational use of the prediction equation and WIND systems, and preliminary climatological summaries for each of the missile test ranges. Author

N64-31679 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.
NIKE-APACHE SPEEDBALL II (ROUND NR. 49 SN 22), 12 MAY 1964 Meteorological Data Report
Gordon L. Dunaway and Stanley F. Kubinski Jun. 1964 44 p
(ERDA-149; AD-447825)

Meteorological data collected for the launching of Nike-Apache Speedball II, Round Nr. 49, SN-22, are presented. Also presented are the resulting ballistic data. Author

N64-31681 Emmanuel Coll., Boston, Mass. Research Language Center
CONVECTIVE MOTIONS IN CUMULUS CLOUDS [KONVEKTIONYE DVIZHENIIA V KUCHEVYKH OBLAKAKH]
N. I. Vul'fson Bedford, Mass., AFCRL, Dec. 1963 12 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 97, 1954 p 77–80
(Contract AF 19(628)-3869)
(E-T-R-64-14; AD-601207)

The transmitting elements of the electronic thermometers used in this work were made from a copper wire 50 mu in diameter. Cloud measurements were taken simultaneously with two coupled thermometers. Data secured as taken in a post-frontal cold-air mass in the Vologda region (U.S.S.R.) reflect a number of characteristic features of convective motions in cumulus clouds, among which are the following: (1) Dimensions of the cross sections of streams within clouds are greater than those outside the clouds, and they have a wide spectrum up to 700 m. (2) The intensity of streams within clouds is considerably greater than that outside (89% on the average). (3) The relative amount of air raised in streams within the clouds is much greater than it is outside. (4) The dimensions of streams and their intensity increase according to the degree of removal from the cloud base. (5) Convective streams are those ascending from lower lying layers and which have become stronger. (6) The developing cumulus cloud actively draws convective streams into itself from a subcloud space greater in area than the area of the cloud itself. A.W.

N64-31696 Federal Aviation Agency, Washington, D.C. Systems Research and Development Service
DETAILED DESIGN—COMMON AVIATION WEATHER SYSTEM. VOLUME II: SUPPLEMENT
Jun. 1963 88 p
(AD-420177)

A study was made of detailed design and equipment specifications for a common aviation weather system. Appendix A contained the following specifications: "Semiautomatic Meteorological Station" and "Radar Digitizing Equipment." Appendix D contained "Circuit Control High Speed"; "Hub Circuit Control"; High-to-Low Speed Converter"; "High-Speed Transmitter–Distributor"; and "Switching Device." G.G.

N64-31749 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE APPROXIMATE PROBABILITY ANALYSIS OF STRUCTURE OF WIND VELOCITY ABOVE THE SEA
F. A. Dmitriyeva *In its* Herald of the Leningrad U. 28 Jul. 1964 p 116–125 refs (See N64-31742 23-23)

The random distribution and large variation of the wind velocity at a definite place determine the possibility of statistical methods of calculating characteristics of the wind as random values. The determination of correlational and structural functions with the help of empirical data and their comparison with the theoretical ones give a good concordance. The methods of determining the values M (s), mathematical probability, and D (s) dispersion, can be used to predict the wind velocity beyond a certain limit in atmosphere. Author

N64-31758 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSACTIONS OF THE MAIN GEOPHYSICAL OBSERVATORY
I. M. Imyanitova and L. G. Makhotkina 4 Sep. 1964 111 p refs Transl. into ENGLISH of Tr. Gl. Geofiz. Observ. (Leningrad), no. 146, 1963 p 1–75
(FTD-MT-64-124; AD-605405)

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10. THE CHOICE OF UNITS FOR PROCESSING DATA OF ATMOSPHERIC ELECTRIC MEASUREMENTS L. G. Makhotkin p 74–82 refs (See N64-31768 23-21)

11. A PROVISIONAL ESTIMATE OF THE DISTANCE OF THUNDERSTORMS ON THE BASIS OF AMPLITUDES OF ATMOSPHERICS L. G. Makhotkin and P. S. Lydzaya p 83–92 refs (See N64-31769 23-21)

12. LATITUDINAL VARIATION OF ATMOSPHERIC ELECTRICITY ELEMENTS N. A. Paramonov p 93–101 refs (See N64-31770 23-21)

13. THE QUESTION OF CIRCUIT DIAGRAMS OF ASPIRATION CONDENSERS IN ION-COUNTERS Kh. F. Tammet p 102–106 refs (See N64-31771 23-09)

N64-31759 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THUNDERSTORM ACTIVITY IN LENINGRADSKAYA OBLAST' IN 1961

A. I. Astashenko, P. S. Lydzar, and L. G. Makhotkin *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 1–10 refs (See N64-31758 23-21)

Results of observations, made in the summer of 1961 by means of an unidirectional direction finder and a set of thunderstorm-recorders, are summarized. Characteristic peculiarities in distribution of thunderstorms are pointed out, and maps obtained by different methods are compared.

Author

N64-31760 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE DIRECTION-FINDING OF NEAR LIGHTNING DISCHARGES

A. I. Astashenko and L. G. Makhotkin *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 11–21 refs (See N64-31758 23-21)

Data are considered on the necessity of selecting a special circuit for the direction finder of near discharges (up to 200 km), which are not corroborated by results of checks by a unidirectional direction finder with loop antennas. Ordinary unidirectional direction finders have, in most cases, admissible errors even at the smallest distances (up to 20 km). Author

N64-31761 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CERTAIN INFORMATION ON THE RELATIONSHIP BETWEEN ATMOSPHERICS AND INSTABILITY IN THE LOWER LAYER OF THE TROPOSPHERE

K. N. Barkalov *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 22–26 ref (See N64-31758 23-21)

Results of a comparison between radar-detected locations of atmospherics and the state of instability of the atmosphere during April and June 1961 are presented. Some of the conclusions reached are as follows: (1) In comparing sources or groups of the atmospherics with the instability of the atmosphere in its lower layer, a good agreement (93% to 95%) is found. (2) Of the well-expressed zones of instability not recorded by a network of cathode direction-finding stations (in 10% to 15% of the cases), the majority were significantly distant from the base of the direction-finding point and were in the presence of intensive thunderstorm sources close to them. P.V.E.

N64-31762 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE LEVEL OF ATMOSPHERICS AND CERTAIN PECULIARITIES OF THUNDERSTORM ACTIVITY

V. P. Kolokolov and G. I. Pichakhchi *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 27–36 refs (See N64-31758 23-21)

An attempt is made to find conformity between the intensity of atmospherics and the total duration of thunderstorms (in hours). Also, certain relationships are established between different climatological characteristics of thunderstorm activity, examined over a great area. Author

N64-31763 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESEARCHES ON THE CHARACTERISTICS DETERMINING THE ELECTRICAL CHARGES OF DROPLETS OF VARIOUS SOLUTIONS

V. I. Kraav *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 37; 2 refs (See N64-31758 23-21)

Data are presented showing that electric charges on drops obtained by atomozing various solutions are not single-valued functions either of the pH value or of the electrical conductivity. It is suggested that charges on droplets, obtained by atomizing the various solutions, do not depend on the total conductance but on the relationship of the polar conductance of the initial solution. P.V.E.

N64-31764 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ELECTRICAL CHARACTERISTICS OF FOGS IN VICINITY OF SVERDLOVSK

L. A. Krutova *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 43–47 refs (See N64-31758 23-21)

Data are presented showing the characteristic variation of atmospheric-electrical characteristics during fogs (as well as smoke and haze). Fogs at Sverdlovsk are observed most frequently in the second half of the summer and at the beginning of autumn (July through September). The maximum in their annual variation occurs in August, and the minimum occurs in March. The types of fogs are distributed as follows: general fog, 40%; shallow, 30%; and ground, 28%. P.V.E.

N64-31765 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON VARIATION OF ELECTRIC POTENTIAL GRADIENT OF THE ATMOSPHERE IN MIRNY
T. V. Lobodin *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 48–52 refs (See N64-31758 23-21)

Data on gradient variations in the electric potential of the atmosphere on the basis of measurements at the Antarctic Observatory at Mierny during the IGY (1958), are presented for a total of 81 days. Certain variation is noted in the shape of the curve of unitary variation of the potential gradient E—a shift of the minimum values to morning hours in comparison with data obtained earlier. Author

N64-31766 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STATISTICS OF LIGHTNING DISCHARGES
L. G. Makhotkin and K. A. Semenov *In its* Trans. of the Main Geophys. Obs. 14 Sep. 1964 p 53–66 refs (See N64-31758 23-21)

General statistical evaluations are used for investigating characteristics of various instruments by means of which it is possible to record lightning discharges. Data are obtained on the relationship between the magnitude of abrupt change in field strength and the distance up to discharge, the distribution of abrupt changes in field by magnitude, and the influence of threshold value on the number of discharges obtained. Results of comparison of the calculated and experimental data corroborate the correctness of the selected statistical method. Author

N64-31767 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRIC FACTORS IN THE PURITY OF THE ATMOSPHERE
L. G. Makhotkin *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 67–73 refs (See N64-31758 23-21)

Almost all atmospheric-electrical elements, to a greater or smaller degree, depend on the pollution of the atmosphere. By considering a number of atmospheric-electrical characteristics, it is possible to point out cases of a direct dependence of values of individual elements of atmospheric pollution. Certain elements (or their combination) are unique indices of the atmosphere's purity. Possibilities of using various electrical characteristics for evaluating the purity of the atmosphere are reviewed. P.V.E.

N64-31768 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE CHOICE OF UNITS FOR PROCESSING DATA OF ATMOSPHERIC ELECTRIC MEASUREMENTS
L. G. Makhotkin *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 74–82 refs (See N64-31758 23-21)

Since data on measurement accuracy are sometimes indicated only for the qualitative characteristic of the method and are not used in processing the results of observations, it is proposed certain practical units be replaced by more suitable units. Author

N64-31769 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A PROVISIONAL ESTIMATE OF THE DISTANCE OF THUNDERSTORMS ON THE BASIS OF AMPLITUDES OF ATMOSPHERICS
I. G. Makhotkin and P. S. Lydzaya *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 83–92 refs (See N64-31758 23-21)

An analysis of experimental and theoretical data shows that it is possible to estimate roughly the logarithm of the distance to nearby thunderstorms from the amplitudes of the atmospherics. The scale for estimating the distance corresponds approximately to a geometric progression with the denominator 2. Author

N64-31770 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LATITUDINAL VARIATION OF ATMOSPHERIC ELECTRICITY ELEMENTS
N. A. Paramonov *In its* Trans. of the Main Geophys. Obs. 4 Sep. 1964 p 93–101 refs (See N64-31758 23-21)

The latitudinal distribution of the chief elements of atmospheric electricity is analyzed. It is determined that the magnitude of the elements of atmospheric electricity, observed at different stations on the same latitude, greatly differ from each other, indicating the influence of local factors. Author

N64-31804 Air Force Cambridge Research Lab., Bedford, Mass. Optical Physics Lab.
ALTITUDE VARIATION OF RAYLEIGH, AEROSOL, AND OZONE ATTENUATING COMPONENTS IN THE ULTRAVIOLET REGION Experimental Research Papers No. 20
L. Elterman May 1964 35 p refs
(AFCRL-64-400; AD-606112)

Atmospheric extinction in the ultraviolet is considered spectrally and with altitude as follows: (1) The Rayleigh scattering coefficients are determined by utilizing spectral scattering cross sections with molecular number densities from the U.S. Standard Atmosphere. (2) The aerosol attenuation coefficients are established from available transmission measurements in conjunction with a suitable aerosol density distribution. (3) The atmospheric ozone absorption coefficients result from Vigroux's coefficients applied to a generalized ozone distribution. The resulting coefficients and computed optical thickness values are placed in the format of a series of tabulations for wavelengths from 0.27μ to 0.55μ, with the parameters arrayed at kilometer intervals to an altitude of 50 km. The tabulations presented permit various exploratory calculations including horizontal, vertical, and slant-path transmission from sea level and from space into the atmosphere, and also between any two desired altitudes within the occluding ozone region. Author

N64-31809 Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
APPARENT SKY TEMPERATURES AT MILLIMETER-WAVE FREQUENCIES Physical Sciences Research Papers No. 38
Karl N. Wulfsberg Jul. 1964 36 p refs
(AFCRL-64-590; AD-605813)

Measurements of apparent sky temperatures taken over a 1-year period at 15, 17, and 35 Gc are summarized. Sky temperature profiles for various meteorological conditions are presented, as well as curves showing the percentage time distributions for various zenith angles. Such factors as absorption and radiation by oxygen and water vapor, extrapolation of the data to other geographical areas, and the relation between total attenuation of the atmosphere and sky temperature are discussed. A description of the radiometers and the calibration techniques is included. Author

N64-31812 Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
TROPOPAUSE DEFINITION AND HOURLY FLUCTUATIONS Environmental Research Papers No. 41

Arthur J. Kantor Aug. 1964 31 p refs
(AFCRL-64-660; AD-605838)

A detailed study of the tropopause and its hourly fluctuations has become possible through a unique 7-day series of hourly rawinsonde observations. Tropopauses have been grouped serially, according to synoptic events and tropopause pressures, into those with rising or falling pressures (moving) and those with little or no pressure change (stationary). Hourly tropopause pressures have been estimated and standard errors of estimate computed for each tropopause set by least squares regression. Standard errors of estimate are 10 to 18 mb for both moving and stationary tropopauses, and 4 to 6 mb for stationary tropopauses during barotropic conditions. Author

N64-31834 Deutscher Wetterdienst, Offenbach Am Main (W. Germany) Research Div.
RESEARCH IN OBJECTIVE WEATHER FORECASTING Summary Report No. 2, 1 Jul.–31 Dec. 1963
K. Hinkelmann et al [1963] 212 p refs
(Contract AF 61(052)-373)
(AFCRL-64-600; AD-604049)

Some of the ten studies included deal with improvements of the numerical integration techniques. In order to increase the horizontal resolution without reduction of the grid increment, the so-called Eliassen-grid and a more realistic lateral boundary condition were introduced and successfully tested with the unfiltered model of the homogeneous atmosphere. Marked progress by use of the Eliassen-grid approximation was observed also with the baroclinic 5-level model. Numerical stability properties of the unfiltered baroclinic model were studied. A numerical experiment on the behavior of initially barotropic disturbances in a baroclinic channel is presented. A procedure for solving the balance equation is reported. A calculus is introduced that facilitates the derivation of the ellipticity criterion for more complicated forms of the balance equation. Two papers deal with automatic decoding and objective analysis processes to be applied in order to obtain actual initial data in a format acceptable to computers. A filtered method is considered that does not exclude the noise waves, but rather converts them into harmless phenomena. R.L.K.

N64-31912 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
AEROBEE NASA 4.67 NP Meteorological Data Report
Marjorie Mc Lardie Hoidale Jul. 1964 36 p refs
(ERDA-151; AD-447824)

Meteorological data gathered for the launching of Aerobee NASA 4.67 NP are presented along with calculated ballistic data. Author

N64-32029 Air Weather Service, Washington, D.C.
ESTIMATED FREQUENCIES OF POTENTIAL ICING CONDITIONS AT SPECIFIED ALTITUDES Technical Report 182
David M. Ingram and Jimmie L. Gullion Sep. 1964 19 p refs
(AD-448047)

At the altitudes studied in this report, potential icing conditions are considered to exist in clouds whenever ambient air temperatures are below zero degrees centigrade. Charts are presented of frequencies of potential icing at 5000 ft, 10 000 ft, and 15 000 ft, and for the months of January, April, July, and October. Cloud amounts 6/10 through 10/10 are sufficient for icing to occur. Standard deviations of temperature at 850, 700, and 500 mb are considered representative of those at 5000 ft, 10 000 ft, and 15 000 ft, respectively. Frequencies of temperatures below zero degree centigrade at any altitude are statistically independent of frequencies of cloud amount at the same level. Information depicted can be used to assess operational feasibility of aircraft and equipment. A.W.

N64-32034 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
NOCTILUCENT AND NACREOUS CLOUDS. CIRRIFORM CLOUDS. CONDENSATION TRAILS An Author Bibliography
Marjorie Mc Lardie Hoidale Aug. 1964 139 p refs
(ERDA-181; AC-446672)

N64-32039 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
SPECTRAL TRANSMISSIVITY OF THE EARTH'S ATMOSPHERE IN THE 250 TO 500 WAVE NUMBER INTERVAL PART I: METEOROLOGICAL DATA PROCESSING
Glenn B. Hoidale, Charles W. Querfeld, James T. Hall, and Ramon Mireles Sep. 1964 48 refs
(ERDA-186; AD-448070)

In connection with a project to examine the effects of the earth's atmosphere on the transmission of infrared radiation, it was necessary to estimate certain meteorological conditions encountered by this radiation in the last few kilometers of a path from the sun to a ground-based spectrometer. This report briefly describes the spectrometer sites, the meteorological data utilized, and the computer-adapted processing of the requisite meteorological elements. The result of the processing is a layer profile for each spectrometer run. Each layer is characterized by a mean pressure, mean temperature, and precipitable water. The moisture conditions for the period of the field study, as estimated by these procedures, are presented. Author

N64-32091 Freie U., Berlin (W. Germany) Institut für Meteorologie und Geophysik
DAILY AND MONTHLY NORTHERN HEMISPHERE 30-MILLIBAR SYNOPTIC WEATHER MAPS OF THE YEAR 1963: PART II, APR.–JUN.
Barbara Kriester, Karin Labitzke, Drazen Poze, Richard Scherhag, and Renate Stuhrmann 1963 107 p refs *Its* Meteorologische Abhandlungen, V. 39, No. 2
(Contract DA-91-591-EUC-2857)
(QTSR-2; AD-421588)

The stratospheric circulation during the second quarter of 1963 is summarized, and the differences between June 1963 and June 1962, in temperatures, geopotentials, and mean vector winds over Berlin are tabulated. Mean monthly 30-millibar maps and maps of the month-to-month variation of the 30-millibar map are presented. Daily 30-millibar synoptic weather maps are given in sections by month. D.E.W.

N64-32124 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
AEROBEE KP 3.4, 7 APRIL 1964 Meteorological Data Report
Marjorie Mc Lardie Hoidale May 1964 37 p refs
(ERDA-143; AD-444416)

Meteorological data gathered for the launching of Aerobee KP 3.4 are presented along with calculated ballistic data. Author

N64-32131 Emmanuel Coll., Boston, Mass. Research Language Center
THE INFLUENCE OF THERMAL STRATIFICATION AND WIND VELOCITY ON THE WIND PROFILE IN THE GROUND LAYER

Ting Shich-Cheng Bedford, Mass., AFCRL, May 1963 20 p refs Transl. into ENGLISH from Peking U. J.: Nat. Sci. (China), v. 4, no. 3, 1958 p 305–313
(Contract AF 19(604)-8505)
(E-T-Ch-63-6; AD-420441)

This paper deals primarily with finding a general expression for the wind profile in the ground layer and approximate expressions for the cases $R_i < 1/2\ R_{ic}$ and $R_i \cong R_{ic}$; it also studies the influence of thermal stratification and wind velocity on the wind profile in the ground layer for the case $R_i < 1/2\ R_{ic}$. A comparison of these results with Deacon's exponential law reveals the relationships between the exponent β, the Richardson number R_i, and height. Author

N64-32160 Atomic Energy Commission, New York, N.Y. Health and Safety Lab.
ENVIRONMENTAL RADIATION MEASUREMENTS IN THE SOUTHEASTERN, CENTRAL AND WESTERN UNITED STATES, 1962–1963
Harold L. Beck, William J. Condon, and Wayne M. Lowder Apr. 1964 38 p refs
(HASL-145) OTS: $1.00

A 5 × 3in. NaI(Tl) detector and a high-pressure ionization chamber have been used to obtain gamma ray spectra and total gamma dose rates at approximately 100 locations during the course of several survey trips in the southeastern, central, and western United States. Reasonably precise estimates of the dose rates from each of the individual components of both the natural and fallout gamma fields are made using the pulse height spectra and relatively simple methods of analysis. The equipment and types of locations surveyed are discussed briefly, and the methods used for determining component and total dose rates from the pulse height spectra are summarized. The total terrestrial dose rates as well as the partial dose rates from the uranium-238 series, thorium-232 series, potassium-40, zirconium-niobium-95, and rhodium-106 are tabulated for each location. Author

N64-32177 RAND Corp., Santa Monica, Calif.
SELECTED HYGROMETRIC TABLES FOR LOW TEMPERATURES AND PRESSURES
M. T. Klappert and G. G. Schilling Aug. 1964 45 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4244-PR; AD-604856)

Studies of the upper atmosphere of earth and the atmospheres of other planets require a knowledge of the basic thermodynamic properties of water vapor under low ambient temperatures and pressures. Selected portions of hygrometric tables have been extended through machine computations to meet this demand. In the first two tables is a tabular listing of the saturation water-vapor pressure over ice between temperatures of 100° and 200° K. In the third table are listed the saturation mixing ratios of water vapor over ice between 125° and 270° K for atmospheric pressures ranging from 700 to 10^{-5} mb. Finally, tabular and graphical presentations of saturation water-vapor pressures and mixing ratios are given for the 1962 U.S. Standard Atmosphere to an altitude of 99 km. Author

N64-32237 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION INTO THE APPLICABILITY OF THE NORMAL LAW OF DISTRIBUTIONS OF RANDOM QUANTITIES FOR THE DERIVATION OF WIND-REGIME CHARACTERISTICS IN THE FREE ATMOSPHERE
S. V. Solonin and Yu. M. Liberman 4 Aug. 1964 18 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery, Leningrad Univ., no. 1, 1963 p 60–70
(FTD-TT-64-357/1+2; AD-605462)

The article presents the results of the evaluation and analysis of materials from radiosonde observations in the districts of Moscow and Sverdlovsk as to the possibility of using the normal law of random-quantity distribution for the derivation of climatic characteristics with respect to wind in the free atmosphere. From analysis of the computations and graphs by which the observations were plotted and shown, it is seen that, on the whole, the coincidence of theoretical and actual curves is completely satisfactory with respect to both velocity and direction. A.W.

N64-32309 Commonwealth Scientific and Industrial Research Organization, Sydney (Australia) Radiophysics Div.
CLOUD SEEDING EXPERIMENT IN NEW ENGLAND, NEW SOUTH WALES, AUSTRALIA. REPORT ON THIRD YEAR'S OPERATION, 1960 Annual Report
E. J. Smith, E. E. Adderley, and F. D. Bethwaite May 1963 137 p
(RPR-145)

The rainfall figures suggest an increase caused by seeding with a magnitude between those of the previous years. There was an unequal distribution of rainfall between the north-seeded and south-seeded periods. Author

N64-32310 Commonwealth Scientific and Industrial Research Organization, Sydney (Australia) Radiophysics Div.
CLOUD SEEDING EXPERIMENT IN NEW ENGLAND, NEW SOUTH WALES, AUSTRALIA. REPORT ON FIRST YEAR'S OPERATION, FEBRUARY 1958–DECEMBER 1958 Annual Report
E. J. Smith, E. E. Adderley, and F. D. Bethwaite Feb. 1963 136 p
(RPL-161)

The experiment made a successful start. From the operational point of view no particular problems were encountered. Rainfall figures suggest that cloud seeding may have caused an increase in precipitation. Author

N64-32311 Commonwealth Scientific and Industrial Research Organization, Sydney (Australia) Radiophysics Div.
CLOUD-SEEDING EXPERIMENT IN NEW ENGLAND, NEW SOUTH WALES, AUSTRALIA. REPORT ON SECOND YEAR'S OPERATION, 1959 Annual Report
E. J. Smith, E. E. Adderley, and F. D. Bethwaite Mar. 1963 121 p
(RPL-163)

The rainfall figures suggest that any increase caused by seeding was much less than that suggested by the 1958 figures. There was an unequal distribution of rainfall between the north-seeded and south-seeded periods. Author

N64-32312 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.
ATHENA FLIGHT NUMBER 002, 16 JUNE 1964 Meteorological Data Report
H. M. Richart Jul. 1964 39 p refs
(ERDA-153; AD-448627)

Meteorological data gathered for the launching of Athena Flight Number 002 are presented for ballistic studies. The data are presented in tabular form. Author

N64-32313 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

AEROBEE NB 3.147 (NRL 89), 16 JUNE 1964 Meteorological Data Report

Marjorie Mc Lardie Hoidale Jul. 1964 43 p refs
(ERDA-154; AD-448629)

Meteorological data gathered for the launching of Aerobee NB 3.147 (NRL 89) are presented, along with calculated ballistic data. Author

N64-32314 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Data Report

NIKE-APACHE SR-018, 12 JUNE 1964 Meteorological Data Report

Marjorie Mc Lardie Hoidale Jul. 1964 41 p ref
(ERDA-155; AD-448628)

Meteorological data gathered for the launching of Nike-Apache SR-018 are presented along with calculated ballistic data. Author

N64-32315 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

NIKE-APACHE SPEEDBALL II (ROUND NR. 50 SN-17), 14 MAY 1964 Meteorological Data Report

Gordon L. Dunaway Jul. 1964 36 p
(ERDA-162; AD-448630)

Meteorological data collected for the launching of Nike-Apache Speedball II, Round Nr. 50, SN-17, are presented along with resulting ballistic data. Author

N64-32316 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

NIKE-APACHE SPEEDBALL II (ROUND NR. 51 SN-23), 20 MAY 1964 Meteorological Data Report

Gordon L. Dunaway Jul. 1964 51 p
(ERDA-163; AD-448631)

Meteorological data collected for the launching of Nike-Apache Speedball II, Round Nr. 51, SN-23, are presented. Also presented are the resulting ballistic data. Author

N64-32317 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

NIKE-APACHE SPEEDBALL II (ROUND NR. 48 SN-16), 22 APRIL 1964 Meteorological Data Report

H. M. Richart Jul. 1964 60 p
(ERDA-164; AD-448632)

Meteorological data collected for the launching of Nike-Apache Speedball II, Round Nr. 48, SN-16, are presented, along with resulting ballistic data. Author

N64-32318 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteoroligical Support Div.

AEROBEE KP 3.6, 19 JUNE 1964 Meteorological Data Report

Marjorie Mc Lardie Hoidale Jul. 1964 39 p refs
(ERDA-166; AD-448768)

Meteorological data gathered for the launching of Aerobee KP 3.6 are presented along with calculated ballistic data. Author

N64-32319 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

ATHENA FLIGHT NUMBER 003, 8 JULY 1964 Meteorological Data Report

Gordon L. Dunaway Jul. 1964 36 p
(ERDA-167; AD-448767)

Meteorological data gathered for the launching of Athena Flight Number 003 are presented for ballistic studies. The data are presented in tabular form. Author

N64-32320 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Environmental Sciences Directorate

ATHENA LAUNCH ANGLE DETERMINATIONS

Louis D. Duncan, Ronald J. Ensey, and Bernard F. Engebos Sep. 1964 25 p refs
(ERDA-187; AD-447335)

An interpolation technique for computing launch angles for the Athena has been investigated. The primary purpose of this technique is to decrease the processing time for determining launcher settings from measured atmospheric conditions. The technique developed results in a much more rapid computation of launcher angles with negligible loss in accuracy. Author

N64-32328 Joint Publications Research Service, Washington, D.C.

METHODS AND INSTRUMENTS FOR METEOROLOGICAL OBSERVATIONS

6 Oct. 1964 144 p refs Transl. into ENGLISH of 12 articles from Tr. Vsesoyuznogo Nauchnogo Meteorol. Soveshch. Vol. IX. Pribory i Metody Nablyudeniy Leningrad, Hydrometeorol. Publ. House, 1963
(JPRS-26742; TT 64-41999) OTS: $4.00

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7. REQUIREMENTS ON AEROLOGICAL DATA FOR USE IN NUMERICAL METHODS OF ANALYSIS AND FORECASTING L. S. Gandin p 73–81 refs (See N64-32335 23-21)

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9. INSTRUMENTS FOR MEASURING RAINDROP SIZES INSTALLED ON AN AIRCRAFT AND A RADIOSONDE I. M. Imyanitov, V. V. Mikhaylovskaya, and B. F. Yevteyev p 94–107 refs (See N64-32337 23-15)

10. A METHOD AND INSTRUMENT FOR DETERMINATION OF THE MICROSTRUCTURE OF CLOUDS AND FOGS K. S. Shifrin and V. I. Golikov p 108–118 refs (See N64-32338 23-15)

11. AN IMPROVED METHOD OF MEASUREMENT OF THE STRENGTH OF THE ELECTROSTATIC FIELD AT THE SURFACE OF SPACECRAFT IN THE UPPER ATMOSPHERE I. M. Imyanitov and Ya. M. Shvarts p 119–128 refs (See N64-32339 23-15)

12. MEASUREMENT OF SURFACE TEMPERATURE BY THE RADIATION METHOD V. L. Gayevskiy p 129–141 refs (See N64-32340 23-12)

N64-32329 Joint Publications Research Service, Washington, D.C.

PRESENT STATUS AND PROSPECTS FOR DEVELOPMENT OF METEOROLOGICAL MEASUREMENTS

D. P. Bespalov and M. S. Sternzat *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 1–9 refs (See N64-32328 23-21) OTS: $4.00

Increases in the number of meteorological elements that must be measured, the number of times measurements must be made, and the number of meteorological stations require the development of automated meteorological instruments and data processing. The need for reliable specialized instrumentation for the use of meteorological expeditions is also indicated. Although great strides have been made in the last 15 years, the time lag between the development of new instruments and their introduction into the station networks is unjustifiably long. The development of a long-range plan for hydrometeorological instrument making is suggested. M.P.G.

N64-32330 Joint Publications Research Service, Washington, D.C.

STATUS AND PROSPECTS FOR DEVELOPMENT OF AEROLOGICAL OBSERVATION METHODS

P. L. Yefimov *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 10–18 (See N64-32328 23-21) OTS: $4.00

A brief history of the development of meteorological instrumentation in the USSR is presented, followed by a discussion of the present status of meteorological measurement. Current developments include creation of new types of radiosondes and ground radar equipment, automation in temperature–rawin sounding and processing of the results, development of a method for atmospheric sounding aboard a high-speed jet aircraft, and estimation of the accuracy of the various types of instruments in actual network use. M.P.G.

N64-32331 Joint Publications Research Service, Washington, D.C.

COMPLEX AUTOMATION OF THE HYDROMETEOROLOGICAL NETWORK

V. P. Petrov *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 19–34 refs (See N64-32328 23-21) OTS: $4.00

The basic principles and structural characteristics of Automatic Meteorological Telemetric Station (AMTS) are presented as the result of a preliminary study of the automation of the network system of the U.S.S.R. The envisioned AMTS is a combination computer, printer, and telegraphic transmitter; it can be used either in the field or as a local adjunct to existing telegraph centers. It will be adaptable to numerical forecasting methods when they are developed. M.P.G.

N64-32332 Joint Publications Research Service, Washington, D.C.

EXPERIENCE IN THE PROCESSING OF THE RESULTS OF AEROLOGICAL OBSERVATIONS USING ELECTRONIC COMPUTERS

M. V. Krechmer and G. A. Smirnov *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 35–48 refs (See N64-32328 23-21) OTS: $4.00

Problems are discussed that are involved in developing the algorithm and program for conversion of primary aerological information at a computation center. The experience gained in preparing tests for checking the proper operation of the machine with this program is described briefly. Author

N64-32333 Joint Publications Research Service, Washington, D.C.

THE USE OF RADIOACTIVE ISOTOPES IN CERTAIN HYDROMETEOROLOGICAL MEASUREMENTS AND INVESTIGATIONS

A. I. Danilin *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 49–60 refs (See N64-32328 23-21) OTS: $4.00

Selected applications of radioisotopes in hydrometeorological investigations are discussed. The advantage of radioisotope techniques is that measurements can be made without disrupting the medium in which a particular process is being investigated. Many of the possible harmful radiation effects can be avoided by proper protective measures. The use of gamma rays to determine the water content, accumulation, rate of melting, and density changes of snow is described. Methods of using gamma rays and neutron fluxes to investigate the density and water regime of soil and ground under field conditions are presented. Other applications mentioned briefly include measurement of water evaporation and runoff rates, underwater-current velocity, movement of air and water masses, and determination of suspended alluvium. M.P.G.

N64-32335 Joint Publications Research Service, Washington, D.C.

REQUIREMENTS ON AEROLOGICAL DATA FOR USE IN NUMERICAL METHODS OF ANALYSIS AND FORECASTING

L. S. Gandin *In its* Methods and Instr. for Meteorol. Observations 6 Oct. 1964 p 73–81 refs (See N64-32328 23-21) OTS: $4.00

The problem of determining the optimum distribution of stations in a meteorological network and the maximum admissible distance between them is discussed. Using a formula for the mean square error of the interpolation of a meteorological element at the center of a regular triangle formed by stations, the accuracy of the representation of the field between stations is estimated. This value is used to establish where superfluous stations exist and where additional stations are necessary to maintain the desired accuracy. A discussion of what this accuracy should be is also included. M.P.G.

N64-32422 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Meteorological Support Div.

ATHENA FLIGHT NUMBER 01 Meteorological Data Report

Len E. Carter Mar. 1964 35 p refs

(ERDA-119; AD-442719)

Meteorological data gathered for the launching of Athena Flight Number 01 are presented for ballistic studies. The data are presented in tabular form. Author

N64-32478 McGill U., Montreal (Canada) MacDonald Physics Lab.
PRECIPITATION PROFILES FOR THE TOTAL RADAR COVERAGE
P. M. Hamilton Sep. 1964 159 p refs
(Contract AF 19(628)-249)
(MW-37; AFCRL-64-732; AD-606679)

Vertical profiles of the total precipitation in the area scanned by a radar have been obtained for the first time. Profiles for summer shower situations commonly show an accumulation of precipitation aloft. Its height is observed to increase with the available energy of convection. This observation has been combined with calculations by other researchers to give a three fold relation among mean updraft speed, height of accumulation, and energy of convection. Profiles for continuous rain are quite distinct from those of showers, generally showing the greatest amount of precipitation at the base of the storm. Author

N64-32501 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK DATA PROCESSING AND PUBLICATION
Edward C. Kinsloe Jul. 1964 63 p refs
(ERDA-152; AD-448063)

Measurements of wind, temperature, and density of the atmosphere between 30 and 80 km have been conducted in the North American area in a systematic program. These data have been acquired at missile range sites by a number of cooperating governmental agencies in the pursuit of their particular research programs. A comprehensive program for the assimilation, processing, and publication of the acquired data has been devised and implemented to assure availability of the information in a uniform format for immediate study by atmospheric scientists. The details of the data processing and publication techniques are presented in this report. Author

N64-32545 Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
WIND PROFILE DESIGN CRITERIA GOAL VS APPROACH
Interim Notes on Atmospheric Properties No. 38
Norman Sissenwine 2 Jan. 1964 6 p refs *Its* Interim Notes on Atmospheric Properties No. 38
(AD-448623)

A discussion on different approaches to the consideration of wind profiles in the design of aerospace launch vehicles, as related to the design goals, is presented. It is indicated that there are two general aspects to be considered in arriving at the methodology to be utilized in a design investigation—the goal and the approach. The goal of the investigation is very closely related to the design philosophy or to the development of a design philosophy. Four separate goals are considered: (1) understanding; (2) loosely planned; (3) closely planned; and (4) military critical. Several approaches having some place in the design spectrum are discussed: (1) typical wind profile; (2) synthetic (or discrete) calculated-risk wind profiles; (3) simplified equations of motion-influence coefficient matrix; and (4) statistical loads survey. P.V.E.

N64-32587 Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF NUMERICALLY DETERMINED DIVERGENT AND NON-DIVERGENT WINDS TO GEOSTROPHIC WINDS
Fred Ernst Lacey (M.S. Thesis) [1963] 38 p refs
(AD-601704) OTS: $2.00

Numerical weather analysis relies heavily on numerically computed winds both for direct output and internally for calculating advection and other purposes. It is the intent of this paper to compute, analyze, and compare the geostrophic, the nondivergent, the divergent, and a combination of the latter two. Where a significant difference between these numerically derived winds occurs, an attempt is made to compare each to the observed winds. This study is made for all standard levels through 300 mb. Author

N64-32593 Weather Bureau, Washington, D.C.
STUDIES ON THE METEOROLOGY OF GREENLAND
Interim Report, 15 Jun. 1962–15 Mar. 1963
P. Putnins and W. L. Schallert [1963] 124 p refs Sponsored by Army
(IR-2; AD-421022)

Investigations into the propagation of pressure changes and the problem of the contribution of the troposphere and the stratosphere to surface pressure changes indicate that propagation is more clearly apparent from the surface upward than vice versa, and that, in the majority of cases, the contribution of the troposphere, arbitrarily assumed to be 10-km thick, is over 50% to the surface pressure changes. No ordered relationship was found between amplitudes, percent of variance, or phases of any harmonic and station elevations on seasons as a result of studies of the harmonic components of surface wind speeds. Investigations were also made into some problems of the atmospheric circulation around the southern part of Greenland with not too conclusive results. A.W.

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-31510 Naval Air Test Center, Patuxent River, Md.
OPERATIONAL PROBLEMS IN LOW-ALTITUDE HIGH-SPEED MISSIONS
Lawrence C. Baldwin and Dwight C. Owings *In* ONR Visual Display, and Control Problems Related to Flight at Low Altitude [1964] p 26 (See N64-31508 23-14) OTS: $3.00

Evaluation of devices or systems designed for flying the low-altitude mission should be based on the effect of the following variables upon the probability of mission success: terrain, atmospheric and visibility conditions, intelligence information, target identification, compatibility of attack weaponry with initial low altitude, reliability and accuracy, pilot-crew training, and mission duration. M.P.G.

N64-31717* Northrop Space Labs., Huntsville, Ala.
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES TASK ORDER N-36 REPORT ON CONCEPTUAL NAVIGATION SYSTEM
Doyle Thomas Huntsville, Ala., NASA Marshall Space Flight Center, Oct. 1964 28 p refs
(Contract NAS8-11096)
(NASA-CR-61013) OTS: $2.00 fs; $0.50 mf

Two methods of position determination were studied: (1) position determination utilizing orbital parameters of the CSM; and (2) position determination utilizing celestial bodies as

references. Of the two methods studied, it was concluded that the latter offered the most in accuracy. Position determination by celestial navigation offers high accuracy by extending the observations to three or more bodies. Useful position information may be obtained, however, from the observation of a single celestial body. The navigation system proposed herein is based on the use of a celestial-body tracker mounted on a stable platform as the primary method of position determination. A backup dead-reckoning system is provided for redundancy and for aid in driver control. Author

N64-31862 Joint Publications Research Service, Washington, D.C.
ON THE SUBJECT OF EVALUATION OF VARIOUS TYPES OF INERTIAL NAVIGATIONAL SYSTEMS
Ye. G. Smenkovskiy *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 72–79 ref (See N64-31851 23-15)
OTS: $5.00

Various types of inertial systems are discussed with respect to their use in moving objects. Three general groups of inertial navigational systems (INS) are considered: (1) the INS with platforms stabilized in the plane of true horizon; (2) the INS with platforms stabilized according to a certain inertial movement; and (3) the INS with platforms rigidly attached to the body of the moving object. P.V.E.

N64-32050 Royal Aircraft Establishment Farnborough (Gt. Brit.)
A NEW SYSTEM OF LANDING GUIDANCE IN AZIMUTH, ELEVATION AND RANGE USING GROUND-COUPLED RADARS [NOUVEAU SYSTEME DE GUIDAGE A L'ATTERRISSAGE EN AZIMUT, SITE, DISTANCE PAR RADARS JUMELES AU SOL]
P. Hugon London, Min. of Aviation, Aug. 1964 16 p Transl. into ENGLISH from Navigation, v. 11, no. 44, Oct. 1963 p 329–342
(RAE-TRANS.-1071)

The system provides guidance in elevation and azimuth on a passive, self-contained airborne receiver under average weather conditions, between a distance of approximately 400 m from the transmitters up to distances greater than 15 000 m. It also provides a range to the transmitters, which distinguishes this system from existing ILS or blind landing systems. Author

N64-32059 Brown U., Providence, R.I. Applied Mathematics Div.
ON THE ANALYSIS AND PREDICTION OF METEOROLOGICAL FIELDS
Walter Freiberger Apr. 1964 32 p
(Contract DA-36-039-SC-87222)
(AD-601745) OTS: $2.00

An attempt to describe the weather in terms of stochastic processes and related concepts is discussed. Some of the possible descriptive statistical techniques applicable to meteorological forecasting are surveyed. Examples are presented of how stochastic models could be formulated, and the problem of predicting random fields from incomplete information is discussed. P.V.E.

N64-32060 Brown U., Providence, R. I.
STATISTICAL METHODS FOR THE EXTRAPOLATION OF METEOROLOGICAL FIELDS
A. M. Yaglom [1964] 30 p refs Transl. into ENGLISH from Proc. of the All-Union Sci. Meteorol. Conf., Vol. II, Leningrad, 1963
(Contract DA-36-039-SC-78222)
(AD-601752) OTS: $2.00

A very simple way to utilize the available supply of meteorological data for the purpose of prediction is discussed. It consists of utilizing the statistical relationships between the different characteristics of the atmosphere for the formation of regression equations, which give future values of some of these characteristics in the form of functions of certain variables related to present or past time. Prediction by means of regression equations is called statistical as opposed to dynamic numerical prediction, both of which are, in turn, contrasted with synoptic prediction. A.W.

N64-32068 Massachusetts Inst. of Tech., Cambridge
SIMPLIFIED SELECTION OF OPTICAL FIX DATA AND A SIMPLIFIED GUIDANCE TECHNIQUE
Willmore Frederick Holbrow, Jr. (M.S. Thesis) 22 May 1964 62 p refs
(AD-602264) OTS: $3.00

A selective strategy for optical measurements in interplanetary navigation is shown in which the geometry of the situation dictates the decision. Variable time of arrival guidance is explained, and correction velocities are computed using the perturbation method and a simplified method based on the line of sight to the destination. The perturbation method is used as the ideal case for finding an empirical relation based on the line of sight. The empirical method derived could be used to check the computer solution in an actual flight, since it may be easily calculated manually by an astronaut. Author

N64-32325 Naval Air Development Center, Johnsville, Pa. Aeronautical Instruments Lab.
SOME USEFUL NOMOGRAMS FOR CIRCULAR ERROR CALCULATIONS
Ronald S. Vaughn 3 Sep. 1963 13 p
(NADC-AI-6361; AD-421469)

Four nomograms are presented for calculating radial errors as a function of time or distance. The nomograms were designed specifically for rapid data reduction for navigation data from inertial and doppler navigation systems. Author

N64-32466 Boeing Co., Renton, Wash. Airplane Div.
ANALYTICAL DETERMINATION OF THE VELOCITY FIELDS IN THE WAKES OF SPECIFIED AIRCRAFT, PHASE II Final Report
W. J. Bennett May 1964 69 p refs
(Contract FA-WA-4450)
(RD-64-55)

This report documents a study for the prediction of the velocity fields in the wakes of fixed-wing and rotrary-wing aircraft. The material comprises part of a larger program directed toward determining safe separation times and distances for aircraft operating in the air terminal traffic pattern. Thirty-three aircraft currently operating within the Air Traffic Control system are analyzed. Numerical data are presented in tabular and curve form for eleven of the aircraft, defining their respective wake velocity fields. A discussion of the assumptions and limitations of the analytical models used is included, along with a discussion of possible correlation of the calculated values with test results. Author

N64-32502 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ATTENDED AREA LET DOWN SYSTEM, MARK I Technical Development Plan
1 Jul. 1964 66p refs

The development plan is presented for a small, man-pack, portable, approach and landing aid that may be used at forward area temporary landing sites to provide letdown guidance to

aircraft under conditions when visible flight rules cannot be used. Developmental efforts of other services are reviewed; the requirements for this system are established; and reliability, maintainability, and funding are outlined. M.P.G.

N64-32543 Weather Bureau, Asheville, N.C. National Weather Record Center
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR NATIONAL AIRPORT, WASHINGTON, D.C. Final Report
Atlantic City, N.J., FAA, Jun. 1964 82 p Sponsored by FAA
For Abstract see N64-31143 22-22
(RD-64-54, Vol. 12)

N64-32585 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
APPROACH AND LANDING SYSTEMS Technical Development Plan
Ralph Bailey et al 1 Jan. 1964 66 p refs
(AD-442741)

A detailed development plan, a reliability program and maintainability program, and a detailed development funding plan are presented for experimental investigation leading to the design of a landing system to be used for formation flights of all Army aircraft under tactical conditions. The system is to consist of a ground transmitter, antenna system, and power supply, and an airborne receiver and display. The ground components will be capable of being paradropped in their own transit cases. One man will be able to quickly set up and operate the equipment. The system will provide azimuth (localizer) and elevation (glide slope) guidance to at least five miles from the landing strip under all flyable conditions. P.V.E.

N64-32598 RAND Corp., Santa Monica, Calif.
PREDICTION OF SLBM IN-PLANE MOTION UNDER VARIOUS DEGREES OF A PRIORI KNOWLEDGE
F. B. Tuteuk Jul. 1964 62 p refs
(Contract ARPA-SD-79; ARPA Order 189-61)
(RM-3848-ARPA; AD-448769)

Observations on the trajectory of an SLBM can be used to estimate parameters of the trajectory and to predict future positions of the SLBM by using standard maximum-likelihood estimation methods. The prediction error is a function of the observation time and the length of time for which the prediction is made, and it also depends on the amount and kind of a priori information available. The prediction error is derived and computed for four different cases as follows: (1) The trajectory is a polynomial in time. (2) The trajectory corresponds to constant-thrust propulsion with unknown thrust parameters. (3) A constant-thrust trajectory has known thrust parameters but unknown time and space origin. (4) A constant-thrust trajectory has only the time origin unknown. In general, the greater the a priori knowledge the greater is the prediction accuracy.
Author

23 PHYSICS, GENERAL

Includes acoustics; cyrogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-31368 Joint Publications Research Service, Washington, D.C.
AXIALLY SYMMETRICAL EXCITATION OF A CONE OF FINITE LENGTH
Ye N. Vasil'yev, A. R. Seregina, and V. G. Kamnev *In its* Izv. VUZov: Radio Eng. 22 Sep. 1964 p 185–190 refs (See N64-31351 23-09) OTS: $6.00

The problem of axially symmetrical excitation of a cone of finite length is reduced to an integral equation that was then reduced to a system of linear algebraic equations and solved by an electronic computer. This method was used to calculate the current distribution on cones of varying vertex angles (10°, 20°, 35°, and 90°). A.W.

N64-31441 Israel Inst. of Technology, Haifa
MEASUREMENT OF A QUANTUM ENSEMBLE BY A CLASSICAL APPARATUS Scientific Rept. No. 5
Asher Peres and Nathan Rosen 2 Feb. 1964 20 p refs
(Grant AF-EOAR-63-107)
(ARL-64-184; SR-5; AD-603719)

A simple model of an ensemble of quantum systems interacting with a classical test body is described, the test body serving to measure the expectation value of a dynamical variable of the quantum systems. An expression is derived for the minimum interaction needed to perform the measurement, and it is shown that an interaction that is strong enough to determine an expectation value will transform a pure-state ensemble into a mixture. The model can be generalized to the case in which the expectation values of several variables are measured. The test body is described by means of quantum mechanics, and its most probable behavior is found to be that corresponding to the previous classical description. Author

N64-31450 Wein U. (Austria)
PHONON DRAG EFFECT AND TRANSPORT COEFFICIENTS Final Technical Report, 1 May 1963–30 Apr. 1964
Walter E. Thirring [1964] 15 p refs
(Contract DA-91-591-EUC-2920)
(AD-603082) OTS: $1.00

The derivation of a formula for electric conductivity is derived for the simplest case, and the critical discussion is presented of its validity. The equation is applied to the simplest situation of a multiple scattering problem, namely electrons in randomly distributed impurity potentials. The calculation is described of a more refined evaluation of the conductivity for a typical many-body problem, such as electrons interacting with phonons. These techniques have been used for the calculation of the electric and thermal conductivity in crystals.
Author

N64-31470 National Lead Co. of Ohio, Cincinnati
ABSORPTION CORRECTION TABLES FOR MICROPROBE ANALYSIS AEC Research and Development Report
J. W. Colby and J. F. Niedermeyer 2 Oct. 1964 72 p refs
(Contract AT(30-1)-1156)
(NLCO-914)

Absorption correction data are tabulated as a function of mass absorption coefficient in increments of 10 from 0 to 5000 and mean atomic number from 4 to 94. They have been specifically calculated for an accelerating voltage of 20 kV and for an X-ray emergence angle of 52.5°. However, an additional table has been included to enable their use with other emergence angles and/or accelerating voltages. Author

N64-31530 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OPTICAL PROPERTIES OF CLOUDS
Ye. M. Feygel'son *In its* Cosmic Res., Vol. 2, No. 3 1964 28 Jul. 1964 p 157–168 refs (See N64-31522 23-29)

A brief survey of the present state of research in cloud optics is presented. Most attention is devoted to theoretical studies on radiation transfer in clouds and the qualitative laws governing reflection and transmission of radiation by clouds without taking the influence of the atmosphere outside the cloud into account. Author

N64-31531 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUATION FOR RELEVANCE OF INFORMATION FROM WEATHER SATELLITES AND FORMULATION OF INVERSE PROBLEMS
G. I. Marchuk *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 169–192 refs (See N64-31522 23-29)

Problems of atmospheric optics and long-wave radiation transfer are considered. Functionals of the basic problems are introduced into the discussion as the readings of instruments of the weather satellite. Adjoint equations related to the corresponding functional of the problem are constructed; these are referred to as equations for relevance of information with respect to the specified functionals. Using the basic and adjoint equations, the paper develops a theory of perturbations. The perturbation-theory formula makes it possible to formulate the corresponding inverse problems of meteorology. Author

N64-31566* National Aeronautics and Space Administration, Washington, D.C.
STABILIZATION OF THE MOTION OF A CONTROLLED MEMBER IN A CONTROL SYSTEM WITH TIME DELAY [O STABILIZATSIY DVIZHENIY UPRAVLYAYEMOGO OB'YEKTA S ZAPAZDYVANIYEM V SISTEME REGULIROVANIYA]
N. N. Krasovskiy and Yu. S. Osipov Aug. 1964 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhn. Kibernetika, (Moscow), no. 6, 1963 p 3–15
(NASA-TT-F-9122) OTS: $1.00 fs; $0.50 mf

The problem of stabilizing the motion of a controlled member involving delayed action of the control system is examined. The solution is obtained within the framework of the theory of stability of motion, the theory of analytical design of control systems, the control theory of linear systems, and the method of canonical representation of the motion of linear periodic systems as developed for systems with aftereffect. It is shown that for the systems under discussion, the stability conditions are reduced to the control conditions for certain finite-dimensional systems corresponding to the eigenvalues λ_i of the monodromic operator of the initial system for which $|\lambda_i| \geq 1$. The analysis is applied to a practical example. Author

N64-31628 European Organization for Nuclear Research, Geneva (Switzerland) Div. of Nuclear Physics
KINEMATIC DISCRIMINATION OF INELASTIC EVENTS IN THE ELASTIC SCATTERING AT MOMENTUM TRANSFER [DISCRIMINATION CINEMATIQUE DES EVENEMENTS INELASTIQUES DANS LA DIFFUSION ELASTIQUE A GRAND TRANSFERT]
J. Banaigs, C. Bonnel, L. Goldzahl, E. G. Michaelis, and F. Plouin 28 Jul. 1964 39 p refs In FRENCH
(CERN-64-38)

The principal difficulties in the study of elastic scattering with large momentum transfer are related to estimating the contribution of inelastic events. Two particularly difficult cases in which the two particles (π-proton and K-proton) have kinematics resembling elastic scattering are considered. A discrimination factor is derived that is important in selecting angular and magnetic factors in certain cases. This precise study of scattering kinematics shows that part of the inelastic events can be eliminated and that a reasonable contamination value can be calculated for the rest. Results of preliminary experiments and error estimates are included. M.P.G.

N64-31673 Naval Ordnance Lab., White Oak, Md.
EFFECT OF ELECTRON SHARING ON THE INTERACTION POTENTIAL FOR A COLLISION BETWEEN A PROTON AND A HYDROGEN MOLECULE
W. J. Glowacki Oct. 1964 59 p refs
(NOLTR-64-85; AD-448470)

Previous determinations of the potential governing the interaction of a proton and a diatomic hydrogen molecule when electron sharing occurs have been limited to the case in which the proton approaches the center of the molecule in a direction normal to its axis. Since, in most scattering calculations, the interaction potential must be averaged over all directions, this work extends the determination of the potential to the case in which the proton approaches along the axis of the molecule. The method of analysis is based on molecular orbitals consisting of linear combinations of atomic orbitals with the nuclear charge being treated as a variational parameter. Author

N64-31680 Emmanuel Coll., Boston, Mass. Research Language Center
COLORED STRATIFICATIONS [STRATIFICATIONS COLOREES]
André Marcelin Bedford, Mass., AFCRL, Oct. 1963 36 p refs Transl. into ENGLISH from J. Chim. Phys. (Paris), v. 28, 1931 p 605–621
(Contract AF 19(604)-8505)
(E-T-F-63-7; AD-440908)

A very thin, transparent plate exhibits the colors of thin sections. When such a plate is subject to basal cleavage, its thickness is an absolute multiple of the thickness of its fundamental crystal structure; the wavelength of the light reflected by the plate is a function of the number expressed by this multiple, and varies discontinuously when the thickness of the section increases by the thickness of a fundamental lamella. This discontinuity is directly observable. Films of soap solution exhibit a general organization into colored stratifications. The thickness of the fundamental step of stratification was measured; it consisted of a double layer of molecules of oleic acid or of oleate. Analogous observations and measurements were made of the colored crystalline stratifications of mica and paratoluidine; in these two cases this step in crystalization corresponds to a monomolecular layer. Author

N64-31705 Sylvania Electric Products, Inc., Mountain View, Calif. Microwave Device Div.
RESEARCH ON TECHNIQUES FOR LIGHT MODULATION DETECTION Interim Engineering Report, Jun. 1–Sep. 1, 1964
E. O. Ammann, E. Lien, E. Illokken, and K. Blotekjaer [1963] 113 p refs
(Contract AF 33(657)-8995)
(IER-5; AD-420403)

This report covers an applied research program to establish techniques for light modulation detection. A background literature investigation showed that two different methods showed promise for obtaining the desired results: (1) the transverse-wave phototube; and (2) the birefringent discriminator. The merits and performance of these two schemes are discussed on the basis of the background information plus additional analyses. These schemes are found to be approximately equal in terms of performance, but differing considerably in complexity of construction. It is concluded that the aims of the

program can be best served by pursuing an investigation of the birefringent discriminator during the remainder of the year. Author

N64-31734 American Meteorological Society, Boston, Mass.
DETERMINATION OF SPECTRAL LINE STRENGTH BY THE EXPANSION CALCULATION METHOD [PRIMENENIE RASSHIRENNOGO METODA RASCHETA DLIA OPREDELENIIA SILY SPEKTRAL'NYKH LINII]
A. P. Iutsis, Ia I. Vizbaraite, and K. K. Eringis Bedford, Mass., AFCRL, Sep. 1963 12 p refs Transl. into ENGLISH from Tr., Akad Nauk Litovskoi SSSR, ser. B, v. 3 (26), 1961 p 99–105
(Contract AF 19(604)-6113)
(T-R-412+; AD-600888)

A definition is given of operators of electric-dipole and quadrupole transitions in irreducible tensor form. In the case of the quadrupole, they differ from the corresponding operator employed in other contexts, because they have a constant factor. Expressions are found that permit a change from the ordinary method of calculation to an extended method in determining the line strength for configurations of two equivalent electrons. Numerical values are given for the line strength in the $1s^2$–$1s2p$, $2p^2$–$1s2p$, and $1s^22p^2$–$1s^22s2p$ dipole transitions for a number of atoms and ions, and in the $2p^2$–$2p^2$ quadrupole transition for the carbon atom. Author

N64-31742 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HERALD OF THE LENINGRAD UNIVERSITY
28 Jul. 1964 200 p refs Transl. into ENGLISH of Vestn. Leningr. Univ., Ser. Mat., Mekh. i Astron. (Leningrad), no. 7, issue 2, 1963 p 1–160
(FTD-MT-64-63; AD-605404)

CONTENTS:

1. REGULAR-FACED POLYHEDRONS V. A. Zalgaller p 1–7 refs (See N64-31743 23-20)

2. ON DIFFERENTIAL PROPERTIES OF BOUNDED GENERALIZED SOLUTIONS OF QUASI-LINEAR SYSTEMS OF THE VARIATIONAL TYPE A. P. Oskolkov p 8–32 refs (See N64-31744 23-20)

3. SEVERAL RESULTS ON THE PROPERTIES OF FUNCTIONS WHICH ARE DEFINED BY TRIGONOMETRIC SERIES WITH MONOTONIC DECREASING COEFFICIENTS I. N. Pak p 33–50 refs (See N64-31745 23-20)

4. INVESTIGATION OF THE PROBLEM OF SCATTERING IN CERTAIN INFINITE REGIONS, I A. G. Ramm p 51–77 refs (See N64-31746 23-23)

5. ON EXTREMAL REGIONS CONNECTED WITH ONE-SHEETED FUNCTIONS Ya. S. Fel'dman p 78–101 refs (See N64-31747 23-20)

6. TURBULENT BOUNDARY LAYER OF A NON-THERMOINSULATED WING OR AXIALLY SYMMETRIC BODY IN A COMPRESSIBLE LIQUID I. P. Ginzburg and G. V. Kocheryzhenkov p 102–115 refs (See N64-31748 23-11)

7. ON THE APPROXIMATE PROBABILITY ANALYSIS OF STRUCTURE OF WIND VELOCITY ABOVE THE SEA F. A. Dmitriyeva p 116–125 refs (See N64-31749 23-21)

8. RELATIVISTIC INTEGRAL KINETIC EQUATIONS N. B. Maslova p 126–142 refs (See N64-31750 23-11)

9. FLOW PAST A BODY REVOLUTION BY A SUPERSONIC FLOW OF GAS A. S. Mikheyev p 143–152 refs (See N64-31751 23-11)

10. ON THE CALCULATION OF A BOUNDARY LAYER BY THE METHOD OF DISMEMBERMENT L. A. Rozin p 153–168 refs (See N64-31752 23-11)

11. PRINCIPLE OF MAXIMUM ABSORPTION IN THE THEORY OF ELASTICITY D. M. Eydus p 169–186 refs (See N64-31753 23-23)

12. ON CENTRAL INTENSITIES OF STRONG FRAUNHOFER LINES OF THE SPECTRUM OF THE SUN D. M. Kuliyev p 187–195 refs (See N64-31754 23-28)

N64-31746 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF THE PROBLEM OF SCATTERING IN CERTAIN INFINITE REGIONS, I
A. G. Ramm *In its* Herald of the Leningrad U. 28 Jul. 1964 p 51–77 refs (See N64-31742 23-23)

The functions are solutions of the scattering problem of a plane wave on a considered surface. A theorem of decomposition according to these functions is developed. All these results are transferred to the domains whose boundaries coincide with the boundary of the triangle $0 < \phi < \alpha$ outside a certain circle. The estimates of the Green functions of the Helmholtz operator in the domain with the unlimited boundary are obtained. A.W.

N64-31753 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRINCIPLE OF MAXIMUM ABSORPTION IN THE THEORY OF ELASTICITY
D. M. Eydus *In its* Herald of the Leningrad U. 28 Jul. 1964 p 169–186 refs (See N64-31742 23-23)

The second boundary problem for the equation of elastic oscillations in an infinite domain Ω with a finite boundary is considered. The domain consists of two parts, each of which is constant. This problem is solved by introducing complex absorption. Author

N64-31775 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING NEW APPLICATIONS OF THERMONUCLEAR REACTIONS
27 Aug. 1964 23 p Transl. into ENGLISH from Novoye v Voyennoy Tekhnike (Moscow), 1958 p 5–19
(FTD-MT-64-230; AD-605734)

The problems associated with obtaining controlled thermonuclear energy for productive, technological, and military applications are reviewed. Many of the problems have been overcome, but the major obstacle still remaining is the economical attainment of the superhigh temperatures required to ignite the reaction without generating an atomic explosion. Possible ways of converting the energy from this "sun-on-earth" reaction are discussed. Military applications considered include thermonuclear bombs (which at present must include atomic detonators), and combat radioactive substances, as well as the means and methods of applying these weapons. M.P.G.

N64-31778 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROSPECTS OF APPLICATION OF NEUTRON GENERATORS IN VARIOUS BRANCHES OF THE NATIONAL ECONOMY
S. I. Savosin *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 10–23 refs (See N64-31776 23-12)

The main types of mechanisms that generate neutrons and the characteristics of each are tabulated and discussed. The present areas of application of each type of generator are indicated; the advantages of wider use of these generators in industry, science, and technology are predicted. M.P.G.

N64-31780 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TUBES OF CONTINUOUS AND PULSE ACTION OF THE FIRM "PHILLIPS"
O. Reifenschweiler *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 37–44 (See N64-31776 23-12)

General characteristics, main design features, ion source, accelerating system, gas-pressure regulator, target design, neutron yield, and productivity are discussed for Phillips sealed neutron tubes that are capable of both continuous and pulsed operation. M.P.G.

N64-31782 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TUBES OF THE "COMAN" FIRM: THREE DIFFERENT ION SOURCES
B. J. Carr *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 54–59 (See N64-31776 23-12)

Tubes for use as neutron generators are discussed. The first is a tube with one source; the ion source, pulse transformer, and titanium–tritium target are considered. The tube with several sources, the recently developed plasma tubes, and the high-voltage accelerator design especially for neutron activation analysis are also discussed. M.P.G.

N64-31784 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PORTABLE PULSE GENERATOR OF FAST NEUTRONS
P. Hawkins and R. V. Sutton *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 74–92 (See N64-31776 23-12)

A study of the factors influencing pulse neutron generators is conducted. By means of a reaction between tritium and deuterium with small sources, maximum flows of 10^{13} neutrons/sec are obtained. A method is developed for maintaining practically constant operating pressure of gaseous deuterium. This allows making a sealed-off and, consequently, portable source. The development of a generator of fast neutrons or a neutron tube based on these principles is described. The tube can generate a flow of $5 \cdot 10^{12}$ neutrons/sec with 100 kV. Author

N64-31785 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVELOPMENT OF A PORTABLE ACCELERATING NEUTRON TUBE OF UNIVERSAL ACTION
E. A. Ab *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 93–104 refs (See N64-31776 23-12)

A detailed description of the design, development, and modification of sealed neutron tubes of the types TUO-2 and TUO-4 is given. Operational characteristics of these tubes, determined in oil-well field tests, are given. M.P.G.

N64-31786 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVELOPMENT OF A PORTABLE SEALED-OFF PULSE SOURCE OF NEUTRONS
J. Howe and G. Pollok *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 105–114 (See N64-31776 23-12)

A pulse neutron source has been developed, the main part of which is a sealed-off tube in which, during discharge between surfaces coated with titanium tritide, tritons will be formed that are accelerated in the direction of the target containing deuterium. The design is described of a tube giving approximately 10^7 neutrons/μsec and having a period of service on the order of several thousand pulses. Author

N64-31788 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF NEUTRON GENERATORS
E. Burrill and M. Mac Gregor *In its* Portable Neutron Generators in Nucl. Geophys. 29 Jul. 1964 p 132–136 (See N64-31776 23-12)

The reactions of neutron tubes utilized in physics, chemistry, engineering, biology, and medicine are discussed. The factors considered include electron bombardment, intensity of the neutron current, and neutron activation. M.P.G.

N64-31797 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SURPRISES OF NEAR-LIGHT SPEEDS: A DIALOGUE ON THE THEORY OF RELATIVITY
Yu. I. Soklovskiy 28 Aug. 1964 32 p refs Transl. into ENGLISH of "Syurprizy Okolosvetovykh Skorostey: Dialog o Teorii Otnositel'nosti" Moscow, Izd. "Zhaniye" Vsesoyuznogo Obshchestva po Rasprostraneniyu Politicheskikh i Nauchnykh Znaniy, 1963 p 1–23
(FTD-MT-64-254; AD-605757)

The author discusses a "special" theory of relativity pertaining to the physical phenomena, a "general" theory of relativity pertaining to the connection between geometry and gravitation during near-light velocity, and their probabilities in manned space flight. G.G.

N64-31864 Joint Publications Research Service, Washington, D.C.
METHODICAL ERRORS OF DIFFERENTIAL STRING CONVERTERS OF ENERGY INTO FREQUENCY
G. A. Kondrashkova *In its* Izv. VUZov: Instr. Building No. 3, 1964 23 Sep. 1964 p 87–92 refs (See N64-31851 23-15) OTS: $5.00

Appraisal is given of the value of methodical errors for the differential string converters of energy into frequency. Recommendations are offered for minimizing methodical errors of these converters. Author

N64-31867 Joint Publications Research Service, Washington, D.C.
MULTIPLE CELL BLACK BODY WITH A LARGE ERADIATION AREA
B. P. Kozyrev and A. A. Buznikov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 103–111 refs (See N64-31851 23-15) OTS: $5.00

Under discussion are various means of achieving the multiplicity of cells of a blackbody with large eradiation area. A description is given of the construction of a multiple-cell blackbody with a 250-mm diameter. The results of laboratory research and the examination of the sample are discussed. Author

N64-31868 Joint Publications Research Service, Washington, D.C.
CONCERNING CORRECTION OF DISTORTIONS IN A NEGATIVE SYSTEM, COMPOSED OF THREE THIN LENSES WITH SYSTEMS PUPIL CARRIED OUT FORWARD
P. D. Ivanov *In its* Izv. VUZov: Instr. Building, No. 3, 1964 23 Sep. 1964 p 112–120 refs (See N64-31851 23-15) OTS: $5.00

Various methods of constructing three-lens negative components in order to improve the distribution of light in wide-angle lenses are examined. On the basis of the examination and calculations presented, it is recommended that in constructing lens, operating in the air, the most advantageous

appears to be utilization of a three-lens negative component with the forward positive correctional lens, and with a strength in the order of 3% to 5% from the strength of the entire negative component. P.V.E.

N64-31876 General Motors Corp., Indianapolis, Ind.
ALLISON RESEARCH AND ENGINEERING, VOLUME NO. 3, THIRD QUARTER 1964
D. H. Jacobson, D. L. Dresser, D. R. Zimmerman, and J. D. Dunlop [1964] 34 p refs

CONTENTS:

1. AN EVALUATION OF LIFT ENGINES IN TACTICAL VOTAL AIRCRAFT D. H. Jacobson p 2–10 (See N64-31877 23-04)

2. RESEARCH IN THERMIONIC ENERGY CONVERSION D. L. Dresser, D. R. Zimmerman, and J. D. Dunlop p 11–29 refs (See N64-31878 23-06)

N64-31918 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
A METHOD FOR CALCULATING NEUTRON AGE
Robert Edward Park (M.S. Thesis) Aug. 1963 72 p refs
(GA/Phys/63-7; AD-419775)

This report describes a method for calculating neutron age values for any homogeneous, nonmultiplying medium. The method accounts for the effects of both inelastic and anisotropic neutron scattering. In the derivation of the method, Fourier transform techniques are used to develop, from the multigroup diffusion model, two simple recursive formulas that generate group average neutron age. The group average neutron ages are then used to estimate the age as a continuous function of lethargy. The method is applied to compute the age to indium resonance from a U-235 fission source in some sample moderators (Be, BeO, C, $C_{12}H_{10}$, and H_2O). Author

N64-31924 United Aircraft Corp., East Hartford, Conn. Research Labs.
ULTRASONIC LIGHT SCANNING AND ACTIVE OPTICAL IMAGING SYSTEM Quarterly Status Report No. 1, 19 Jun.–19 Sep. 1963
Herbert G. Aas, Robert K. Erf, and Irving R. Abel 17 Oct. 1963 43 p refs
(Contract NOw – 63-0657-d)
(B930080-3; AD-420438)

Work on ultrasonic light scanning is reported in which a crystal quartz deflection cell was used; and with an optical path length of 6.76 centimeters in the sound field, deflections as high as 0.77° peak-to-peak were achieved with the cell driven up to one-half the calculated safe input power and at a frequency of 450 kc/sec. Significant results were not obtained in attempts to drive a lucite cell with a barium titanate transducer. A general description of the active optical imaging system is presented, including selection of the mode of scanning, consideration of signal-to-noise ratio, and limitations on the system resolution. Choice of the various system parameters, including light source, photodetector, video amplifier, scanning mechanization, and display is considered in detail. D.E.W.

N64-31928 Israel Inst. of Technology, Haifa
QUANTUM ELECTRODYNAMICS WITHOUT INDEFINITE METRIC Scientific Report No. 6
A. Peres Wright-Patterson AFB, Ohio, Aerospace Res. Labs., 7 May 1964 15 p refs
(Grant AF-EOAR-64-20)
(ARL-64-167; AD-605530)

The electromagnetic potentials $A_a(X)$ are quantized in such a way that their space components are hermitian and their time component antihermitian. On the other hand, the metric in Hilbert space and the Hamiltonian are positive definite. The above formalism, which leads to the usual commutator $[A_a(x), A_b(y)] = ig_{ab} D_0 (x-y)$, is shown to be Lorentz covariant. Physical states are those containing neither longitudinal nor scalar photons (rather than a symmetric combination of the, as in the usual theory). This definition is also Lorentz covariant. The S-matrix is not unitary, but satisfies $PS^*PSP = P$, where P is the projection operator over physical states. In other words, the S-matrix is unitary over the subspace of physical states, this being sufficient for the interpretation of the theory. Author

N64-31958 Wisconsin U., Madison Mathematics Research Center
ON THE GENERAL CONCEPT OF STABILITY AND LYAPUNOV'S DIRECT METHOD
W. Hahn Jun. 1964 53 p refs
(Contract DA-11-022-ORD-2059)
(MRC-485; AD-605642)

A general concept of motion is dealt with covering various types of motions, defined by differential equations, difference equations, etc., as special cases. A general definition of "stability" and "attractivity" of a fixed motion is given, which comprises most of the numerous modifications of the original concept of stability. Lyapunov's direct method, in appropriate extension, is applied in order to obtain general stability criteria for the general type of motions under discussion. Author

N64-31960 Wisconsin U., Madison Mathematics Research Center
A NOTE ON GENERAL RELATIVISTIC INSTABILITY
J. P. Wright May 1964 7 p refs
(Contract DA-11-022-ORD-2059)
(MRC-487; AD-605644)

The point of instability of a general relativistic fluid sphere is determined using the criterion that the point of instability occurs when the binding energy is at a maximum. The result is equivalent to that obtained by the small perturbation method when the radius is sufficiently large. Author

N64-31998 Stanford U., Calif.
A GENERALIZED METHOD FOR TREATING SINGULAR PERTURBATION PROBLEMS
Ali Hasan Nayfeh Jun. 1964 60 p refs
(Contract AF 49(638)-1274; Grant AF-AFOSR-96-63)
(SUDAER-193; AFOSR-64-1306; AD-606083)

Some of the existing methods of treating singular perturbation problems are studied, and a generalized method for solving such problems is developed. The generalized method has been applied to a restricted three-body problem and to a general second-order linear ordinary differential equation with a turning point of arbitrary order. The results of the latter are used in obtaining the asymptotic expansions of the eigenvalues and eigenfunctions of a second-order linear equation with two turning points of arbitrary order. A special case of the eigenvalue problem is the Graetz problem. It arises in finding the temperature distribution of a fluid with constant properties having a parabolic velocity profile that enters suddenly into a round tube whose wall is kept at a different constant temperature. Author

N64-31999 California U., Berkeley Inst. of Engineering Research
DIRECTORS AND MULTIPOLAR DISPLACEMENTS IN CONTINUUM MECHANICS
A. E. Green, P. M. Naghdi, and R. S. Rivlin (Brown U.) Jun. 1964 17 p refs
(Contracts Nonr-222(81); Nonr-562(10))
(AM-64-9; AD-602972)

A general theory of multipolar continuum mechanics has been developed, based on multipolar displacements. A new definition of multipolar displacements is given, and the place of directors in this theory is identified. The dynamical theory of displacements, directors, and dipolar displacements corresponding to the present definitions is outlined, and this contains Ericksen's (1961) theory of liquid crystals as a special case. Explicit constitutive equations are obtained for an elastic continuum under the action of ordinary displacements and directors. Author

N64-32001 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
CHARGE SYMMETRY OF THE AXIAL CURRENT AND RADIATIVE MUON ABSORPTION BY A NUCLEUS
E. Borchi and R. Gatto 12 Jul. 1964 15 p refs *Its* Nota Interna No. 247
(LNF-64/27)

The contribution from a possible second-class axial current to radiative muon absorption by nuclei is examined. This process is very sensitive to the presence of a second-class axial term. It was already noted that the comparison of mirror β-transitions, like B^{12}, $N^{12} \rightarrow C^{12}$ ($\Delta J = 1$, no) or B^8, Li^8($\Delta J = 0$, no), could provide a test for second-class currents. Quite similarly, an inequality of the rates for $\Sigma^{\pm} \rightarrow \Lambda^0 + e^{\pm} + \nu$ would require second-class currents. The present data on these decays are consistent with equal rates of about $(4 \pm 2) \times 10^5$ sec^{-1}; the large experimental error does not allow for any conclusion. Author

N64-32003 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
MEASUREMENTS OF THE RATE OF INTERACTION BETWEEN STORED ELECTRONS AND POSITRONS
C. Bernardini, G. Corazza, G. Di Giugno, J. Haissinski, P. Marin et al 3 Jul. 1964 26 p refs Submitted for Publication *Its* Nota Interna No. 249
(LNF-64/33)

Single bremsstrahlung is a convenient monitoring process. The cross section, which varies only little with energy, is so big that, even at very-low-beam intensities, quite reliable measurements can be made. The separation of beam–gas from beam–beam interactions is quite simple and will be irrelevant in bigger machines with higher particle currents. The target volume determined from counting rates is in good agreement with the deductions drawn from the observation of the lifetimes of single beams (AdA effect). This means that the two beams can be assumed to circulate in identical orbits. Author

N64-32005 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
CALCULATION OF THE RELATIONSHIP RANGE-ENERGY FOR MESONS μ ENDING AT 10^8 MEV [CALCOLO DELLA RELAZIONE RANGE-ENERGIA PER MESONI μ FINO A 10^8 MEV]
R. Scrimaglio and G. Verri 24 Jul. 1964 16 p In ITALIAN *Its* Nota Interna No. 253
(LNF-64/38)

A range-energy relation for mu-mesons is calculated extending the calculation up to 10^5 GeV. Energy losses resulting from ionization, bremsstrahlung, pair production, and nuclear interactions are examined. Trans. by P.F.E.

N64-32012 Argentina Comision Nacional de Energia Atomica, Buenos Aires
RELATIONSHIPS BETWEEN THE EFFICIENT SECTIONS FOR THE ISOMERIC PAIR Ba^{133m} AND Ba^{133}, PRODUCED BY THE REACTION (d, 2n) [RELACIONES ENTRE LAS SECCIONES EFICACES PARA EL PAR ISOMERICO Ba^{133m}, Ba^{133}, PRODUCIDO POR REACCION (d, 2n)]
S. J. Nassiff, A. Mocoroa, M. Caracoche, and H. Vignau 1964 8 p refs In SPANISH *Its* Informe No. 120

The irradiation of Cs^{133} with deuterons from the synchrocyclotron of the CNEA is discussed, and the chemical separation of barium by sulfate precipitation is outlined. The scheme of disintegration of Ba^{133} is described, and counting methods are given. The ratios of effective sections σ_m/σ_g are tabulated and graphed as a function of deuteron energy. D.E.W.

N64-32025 Mellon Inst., Pittsburgh, Pa.
INFRARED SPECTRA OF HIGH-BOILING SUBSTANCES IN INERT MATRICES Final Report, 15 Sep. 1962–31 Aug. 1964
Richard L. Redington [1964] 11 p refs
(Contract DA-31-124-ARO(D)-39)
(AROD-3895-3; AD-449123)

The purpose of the research was to study the nature of matrix isolated monomeric and low polymeric alkali halide species. A liquid-helium cryostat and associated apparatus were designed and built. The infrared spectra of LiF suspended in Ar or Kr containing 1% or 5% of a foreign substituent such as O_2, N_2, CH_4, or CO have been recorded. In an Ar 5% N_2 matrix, the monomeric band of LiF broadens somewhat and broad, weak bands appear at ~829 cm^{-1} and at 816 cm^{-1}. The weak absorption region tails off at ~805 cm^{-1}. The cryostat has a rotatable helium container constructed of heliarc welded stainless steel and is equipped with a conduction-tube arrangement. A.W.

N64-32045 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GAS AND LIQUID LASERS
Chao-Shou Tseng 13 Aug. 1964 9 p Transl. into ENGLISH from Ko Hsueh Ta Chung (China), no. 11, 1963 p 22–23
(FTD-TT-64-565/1+2+3+4; AD-605466)

A brief history of the development of lasers is presented along with an outline of the theoretical principles behind ruby, gas, and liquid laser operation. P.V.E.

N64-32054 Florida State U., Tallahassee
THE CORIOLIS ANTI-PAIRING AND THE BLOCKING EFFECTS IN DEFORMED EVEN-EVEN NUCLEI
Amand Faessler, Walter Greiner (Maryland U.), and Raymond K. Sheline Apr. 1964 28 p refs
(Contract Nonr-1797(00); AT(40-1)-2434)
(TR-372; AD-600709)

The additional effects of the Coriolis anti-pairing and blocking on the 2nd-Order rotational vibrational hamiltonian are discussed for even-even nuclei. This leads to lower limits on the pairing correlation energy (W_o) and the critical spin I_c introduced by Mottelson and Valatin. Typical lower limits deduced from presently available experimental data are W_o = 2 to 3 MeV and $I_c = 24$ (Os^{186}) and 50(U^{238}). The blocking constant, τ, deduced from experiment is in agreement with the theoretical estimate. Author

N64-32058 Stanford U., Calif. High-Energy Physics Lab.
THE PHOTODISINTEGRATION OF THE DEUTERON BY POLARIZED PHOTONS
F. F. Liu May 1964 10 p refs Supported by ONR, AEC, and AFOSR
(HEPL-329; AD-601699) OTS: $1.00

Measurements of the asymmetry function $\Sigma(90°)$ for mean photon energies between 80 and 140 MeV are reported. Electron beams with maximum energies of 400 and 500 MeV were used to produce the polarized bremsstrahlung. A liquid deuterium target was used in the experiment. There is a reversal in the sign of the measured asymmetry somewhere between 120 and 130 MeV photon energy. At this energy level the magnetic amplitude of the photodisintegration process actually begins to exceed the electric amplitude. The data indicated in general that the magnetic amplitude is larger than that suggested by presently available calculations. P.V.E.

N64-32082 Oak Ridge National Lab., Tenn. Civil Effects Test Operations
AN EXPERIMENTAL INVESTIGATION OF THE SPATIAL DISTRIBUTION OF DOSE IN AN AIR-OVER-GROUND GEOMETRY
F. F. Haywood, J. A. Auxier, and E. T. Loy Washington, AEC, 2 Oct. 1964 120 p refs
(CEX-62.14) OTS: $4.00

This paper discusses the influence of the boundary between the atmosphere and the earth's surface on the calculations of the spatial distribution of the neutron or gamma-ray doses. Measurements were made in a neutron as well as in a gamma-ray field from a small bare reactor operating at steady-state power, and in gamma rays from a point gamma source. The experimental data are compared to theoretical models of radiation fields in a finite geometry and found, for the most part, to be satisfactory. The neutron-dose ratio to gamma exposure for most points in the finite medium was found to be independent of the height of the fission source above the air–ground interface, but the presence of the air–ground interface enhanced the measured radiation at slant ranges close to the source. G.G.

N64-32085 Princeton U., N.J. Plasma Physics Lab.
MULTIPLE TIME SCALE APPROACH TO THE DERIVATION OF QUANTUM MECHANICAL KINETIC EQUATIONS
D. Book Jun. 1964 104 p refs
(Contract AT(30-1)-1238)
(MATT-274)

Frieman's multiple time scale method is applied to the quantum mechanical B-B-G-K-Y hierarchy. In general there is a long time scale on which the one-particle distribution relaxes to equilibrium and at least one short time scale that measures the duration of two-particle encounters. For a weakly coupled gas, solutions of the hierarchy are systematically obtained in the first few orders of a perturbation expansion and used to derive the quantum mechanical analog of the Fokker–Planck equation, which is shown to be the Uehling–Uhlenbeck equation in the Born approximation. The expansion parameter ϵ is the ratio of average potential to average kinetic energy, and the short time scale is shorter by ϵ^2 than the long scale. The Coulomb plasma is treated in several cases, including the strongly degenerate and quasi-classical limits, and the appropriate kinetic equations are derived. Author

N64-32114 Air Force Cambridge Research Labs., Bedford, Mass.
CONFIDENCE LEVELS FOR THE SAMPLE MEAN AND STANDARD DEVIATION OF A RAYLEIGH PROCESS Physical and Mathematical Sciences Research Papers No. 48
Leo M. Keane Sep. 1964 12 p refs
(AFCRL-64-737; AD-606556)

The number of independent samples necessary to characterize the parameters of a Rayleigh-distributed process within arbitrary confidence limits is derived. Stationarity of the process is assumed, along with convergence of the Central Limit theorem with regard to the probability density function of the sample mean. Perfect measurement ability is also assumed. A graph of sample size for a range of confidence coefficients and error limits is presented. Author

N64-32120 Texas Western Coll., El Paso Schellenger Research Labs.
SOUND PROPAGATION IN THE SHADOW ZONE EXPERIMENT Quarterly Status Report, Apr.–Jun. 1964
J. R. Provencio 15 Jul. 1964 60 p
(Contract DA-29-040-ORD-2410)
(AD-447807)

The following topics were discussed: "Sound Propagation in the Shadow Zone Experiment", with emphasis on measurement of shock front thickness and on study of the distortion produced in the shock front through the application of a temperature gradient across the tube; "Absorption and Velocity of Sound Measurements," with emphasis on the provisions of temperature control and measurements for a tube designed to measure the absorption of sound in gases, and on the measurement of absorption, with particular attention to oxygen and the effects of impurities; "Thin Films for Temperature Sensing Low Pressure Gases," resulting in the abandonment of silver sulphide as a suitable temperature sensor and substituting instead thin films of germanium with Kovar lead wires and contacts; "Data Analysis Center," providing data for the following projects—Met Rocket Network, Solar Radiation, WINDS, and STAFI. G.G.

N64-32140 Martin Co., Orlando, Fla.
EXCITATION AND DETECTION TECHNIQUES FOR MILLIMETER WAVE TRANSITIONS Fourth Quarterly Progress Report, 1 Apr.–1 Jul. 1963
J. J. Gallagher, R. G. Strauch, and R. E. Cupp Oct. 1963 67 p refs
(Contract DA-36-039-SC-90753)
(OR-3408; AD-421444)

The assembled molecular beam apparatus is described, and calculations are presented on the anticipated beam deflections in a "flop-out" arrangement. The status of supporting investigations is presented. Spectroscopic investigations of hydrogen sulfide are discussed. These topics include centrifugal distortion effects, quadrupole coupling of H_2S^{33}, Zeeman effect of H_2S, and the Stark effect of H_2S. Millimeter wave investigations are reviewed. Author

N64-32152 Centre National de la Recherche Scientifique, Paris (France) Lab. des Hautes Pressions
HIGH VACUUM ULTRAVIOLET EFFECTS Technical Documentary Report, 1 Apr. 1963–31 Mar. 1964
B. Vodar Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1964 13 p refs
(Contract AF 61(052)-679)
(ML-TDR-64-259; AD-606640)

Optimum electrical parameters have been determined for use with the three-electrode vacuum spark to obtain proper operation. The discharge viewed side-on, with the anode perpendicular to the optical axis, does not yield quite as reproducible results as the discharge viewed end-on, where the anode lies on the optical axis and just the diameter of the anode is seen. The photon output is larger with the latter arrangement.

Both uranium and tungsten anodes have been used, and light output measurements show little difference between the two anode materials except below 15 kW. Author

N64-32166 Emmanuel Coll., Boston, Mass. Research Language Center
FORMULAS OF THE SHORTWAVE ASYMPTOTIC IN A PROBLEM OF DIFFRACTION BY CONVEX BODIES [O FORMULAKH KOROTKOVOLNOVOI ASIMPTOTIKI V ZADACHE DIFRAKTSII NA VYPUKLYKH TELAKH]
V. S. Buslaev Bedford, Mass., AFCRL, Mar. 1963 37 p refs Transl. into ENGLISH from Vestn. Lenin. Univ. (Leningrad), No. 13, 1962 p 5–21
(Contract AF 19(604)-8505)
(E-T-R-63-6; AD-601208)

Formulas are derived for the short-wave asymptotic of Green's function $G(x,x^1;k)$ of the external Dirichlet problem for the Helmholtz equation in a plane. The formulas are characterized by a special type of contour integrals. A.W.

N64-32180 Harvard U., Cambridge, Mass. Acoustics Research Lab.
THE DIFFRACTION OF LIGHT BY SOUND Technical Memorandum No. 58
Stephen P. Gill Jun. 1964 235 p refs
(Contract Nonr-1866(24))
(NR-384-903; AD-603745)

The mathematical theory of the diffraction of electromagnetic waves by acoustic waves is fully developed from basic physical principles; earlier work of other authors on the subject is incorporated into the framework, and the analytical development of the theory has been greatly extended. The viewpoints of both quantum mechanics and classical mechanics have been synthesized to suggest analytical insights into the problem. Author

N64-32183 Phillips Petroleum Co., Idaho Falls, Idaho National Reactor Testing Station
A MACHINE PROGRAM FOR CALCULATING SLOW NEUTRON SCATTERING CROSS SECTIONS WITH APPLICATION TO WATER
H. L. Mc Murry and L. J. Gannon Jul. 1964 54 p refs
(Contract AT(10-1)-205)
(IDO-16984)

The scattering by an atom in a complex molecular aggregate is calculated from an equation involving factors associated with the overall translational and rotational degrees of freedom of the aggregate, together with its internal vibrations. The rotational and translational factors are quite easy to calculate. The vibrational factor appears as an infinite sum of terms associated with all possible mechanisms of excitation and de-excitation of the normal modes. For practical purposes it is necessary to limit the number of modes that contribute terms to the vibrational factor by treating modes classically whenever the energy transfer in a collision exceeds the quantum spacing of a vibrational level sufficiently. Furthermore, computations must be restricted to only the significant terms in the vibrational factor. Author

N64-32206 Centro di Studio per la Fisica delle Microonde, Florence (Italy)
LASER CAVITIES TERMINATED BY DIFFRACTION GRATINGS Technical Note No. 1
L. Ronchi and A. M. Scheggi Mar. 1964 33 p refs
(Contract AF 61(052)-536)
(AFCRL-64-355; AD-603967)

A theoretical study is performed of the resonant modes of a laser cavity having end mirrors with periodic reflectivity. A particular example is examined in which the end mirrors are constituted by two identical strip diffraction gratings. The modes and the corresponding eigenvalues are evaluated in successive approximations. It is found that a particular frequency exists for which losses are very low, while neighboring frequencies suffer heavy losses. This effect increases very rapidly with the total number of strips in the grating. Author

N64-32220 Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences
MECHANICS OF MICROMORPHIC MATERIALS
A. Cemal Eringen Apr. 1964 24 p refs Presented at the 11th Intern. Cong. of Appl. Mech., Munich, 30 Aug.–5 Sep. 1964
(Contract Nonr-1100(23))
(TR-26; AD-604520)

The basic ideas and some recent results are presented of a properly invariant continuum theory applicable to "micromorphic" materials. The theory gives rise to some new concepts pertaining to stress moments, inertial spin, and microgyrations, whereby the laws of motion require adjoining certain additional principles to the basic axioms of mechanics. The basic principles are systematically introduced and discussed. Field equations, jump conditions, and constitutive equations for simple microfluids are presented in some detail as an example of the general theory. Some of the previously developed theories of anisotropic fluids are shown to be special cases of the present theory. A theory of linear microviscoelasticity is presented. Author

N64-32239 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POPULAR SCIENCE Selected Articles
13 Aug. 1964 10 p Transl. into ENGLISH from K'o Hseuh Ta Chung (China), no. 12, 1963 p 22–23
(FTD-64-617/1+2+3+4; AD-420607)

Two articles are presented. The first discusses the use of solar sails to provide power for satellites in order to keep them from losing altitude. The second describes a process for changing metallurgical byproduct slags to powders for use as fertilizers. P.V.E.

N64-32246 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ACOUSTIC LOSSES IN A RESONATOR WITH STEADY GAS FLOW Technical Report No. 2
Colin G. Gordon and P. W. Smith, Jr. Jun. 1964 46 p refs
(Contract DA-19-020-AMC-5755-R)
(Rept.-1142; AD-605452)

Measurements have been made of the acoustic losses in a resonator with a small vent, and their dependence on the speed of steady flow through the system and on the position of the vent. The resonator is physically modeled on the "T-Burner" used to test solid propellants for combustion instability, but measurements are made at room temperature and pressure. It is a closed circular cylinder, resonant in the fundmanetal plane-wave mode, with a vent through the wall near the center. Steady gas flow is introduced at one end through a slightly porous piston whose vibration also generates sound. Losses are determined from the rate of decay of pressure. Significant flow-dependent loss attributable to the vent is found for flow speeds in the vent exceeding about 0.02 times the sound speed. Author

N64-32247 Pennsylvania State U., University Park
THEORETICAL ANALYSIS OF INTERNAL BLAST WAVES IN SPHERES Quarterly Progress Report, Apr. 1–Jun. 30, 1964
Norman Davids 30 Jun. 1964 3 p
(Contract DA-36-034-ORD-3576 RD)
(QPR-10)

The purpose of the study is to help find reliable criteria for extrapolating internal blast loading behavior to larger spherical containers. It is being performed concurrently with an experimental investigation on 7-in. and 10-in. spheres. A.W.

N64-32248 Yale U., New Haven, Conn.
[RESEARCH ACTIVITIES ON POLARIZED ELECTRONS AND PRECISION MEASUREMENT OF THE HE^3 NUCLEAR MAGNETIC MOMENT] Status Report
Vernon W. Hughes 1 Jan. 1964 6 p refs
(Contract Nonr-609(11))

The report contains names of articles published or submitted for publication; names and status of personnel associated with projects; graduate students who have earned their doctorates under the contract; and a list of other government-sponsored research with which the principal investigator is associated. Theoretical studies of pulsed operation of the polarized electron source have been made, suggesting approximately the same efficiency of operation for either a pulsed light source or a pulsed electron trap. A.W.

N64-32249 Virginia Polytechnic Inst., Blacksburg
AN APPLICATION OF THE PRINCIPLE OF INCLUSION AND EXCLUSION Research on Order Statistics and the Design of Experiments
M. W. Hume and H. A. David Mar. 1964 61 p refs *Its* Rept. No. 57
(NIH-ST1-GM-2-07; Grant DA-ORD-29)
(AROD-2763-16; AD-441539)

A general procedure that is useful in providing good approximation to upper percentage points of statistics expressible as maxima is often referred to as the principle of inclusion and exclusion. A representative selection of the various statistical applications of this principle in relation to statistics expressible as maxima is presented in this paper. Two alternate methods for the determination of upper percentage points are discussed. Author

N64-32254 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
ATMOSPHERIC ACOUSTIC PROPAGATION
[1964] 23 p refs Proceedings of the 2nd Natl. Conf. on Atmospheric Acoust. Propagation, El Paso, Tex., 22–23 Apr. 1964
(AD-449237)

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N64-32261 Denver U., Colo.
RADIATIVE ABSORPTION OF SOUND
J. B. Calvert *In* AERDA Atmospheric Acoust. Propagation [1964] p 141–150 refs (See N64-32254 23-23)

The radiative properties of atmospheric gases are discussed with respect to the part these properties play in the radiative absorption of sound in the atmosphere. It is concluded that for sound of low frequency, below 1 cycle per second, the principal absorption mechanisms in the atmosphere will be those of vibrational relaxation and radiative absorption, with a negligible contribution from classical, diffusion, and rotational relaxation absorption. It is also concluded that both of the effective mechanisms will be strongly influenced by the concentrations of minor components, vibrational relaxation by the H_2O concentration, and radiative absorption by the concentrations of both H_2O and CO_2. P.V.E.

N64-32262 Army Missile Command, Huntsville, Ala.
WIND INFLUENCE UPON ACOUSTIC FOCUSING
O. M. Essenwanger *In* AERDA Atmospheric Acoust. Propagation [1964] p 151–171 refs (See N64-32254 23-23)

A study was made of the problem of focusing caused by the structure of the wind profile, in an attempt to shed some light on the modification of focusing caused by the wind profile, the spatial extent of the focusing region, and the energy concentration. Examples are presented that demonstrate the role of the wind and its influence upon acoustic focusing for cases where no focusing was expected because of the structure of the thermodynamic part of the sound profile. It is shown that the wind has a modifying effect upon the sound profile, and that focusing may occur downstream. It is concluded that the wind can also change focusing conditions created by the thermodynamic structure of the atmosphere. This indicates that focusing zones attributed to the thermodynamic part of the sound profile are shifted by the wind influence in the area following the windflow. P.V.E.

N64-32263 Texas Western Coll., El Paso Army Electronics Research and Development Activity
ATMOSPHERIC AND TERRAIN EFFECTS ON ACOUSTIC PROPAGATION
H. N. Ballard and L. E. Williamson (Army Electron. Res. and Develop. Activity) *In* AERDA Atmospheric Acoust. Propagation [1964] p 173–185 (See N64-32254 23-23)

The disturbances that were propagated through the atmosphere as a result of the explosion of two 5000-pound TNT

charges were detected by two acoustic-detection systems located approximately 50 miles away. From the known meteorological data, the probable path that the acoustic waves followed from the source to the acoustic receivers is discussed. In addition, some of the characteristics of the received signal, as detected by the acoustic systems, are presented. Based upon the data obtained from the recorded signals and from the probable signal paths, as determined by a ray-tracing technique, the following conclusions are presented: (1) The atmosphere and terrain effects on the acoustic signals were refracted in such a way as to be reflected once from the earth's surface between the point of emanation and the point of reflection. (2) The frequency of the received signals was from 2 to 3 cycles/sec. (3) The amplitude of the received signals was approximately 14 dynes/cm^2. (4) The average speed of the waves was 850 ft/sec. P.V.E.

N64-32265 Naval Postgraduate School, Monterey, Calif.
CLASSIFICATION OF ACOUSTIC SIGNALS INTO A FINITE NUMBER OF CLASSES
Jack R. Borsting *In* AERDA Atmospheric Acoust. Propagation [1964] p 203–215 refs (See N64-32254 23-23)

The classification of an acoustic signal into a finite number of classes should make use of available collateral data, make use of observed acoustic data, provide a decision rule, and provide a measure of confidence for the decision rule. Several statistical classification techniques are discussed, and the manner in which they can be used to satisfy the four requirements is shown. Each technique can be used to meet the general requirements of the intelligence-analysis procedure exactly. It is shown that logical techniques can be set up, using well-defined mathematical techniques of statistical discrimination theory to the signal classification problem. P.V.E.

N64-32266 Northrop Corp., Needham, Mass.
DETECTION OF ACOUSTIC SIGNALS USING A DIGITAL CORRELATOR
Kenton J. Ide *In* AERDA Atmospheric Acoust. Propagation [1964] p 217–231 (See N64-32254 23-23)
(Contract DA-36-039-AMC-03324(E))

The results of a study conducted to evaluate the capabilities of the Mark II correlator system as a signal-detection device are summarized. The Mark II correlator is a device that processes magnetic-tape recordings of acoustic signals received at a four-element array. The study was concerned with the following: (1) indicating the signal-to-noise ratio (SNR) enhancement that may be obtained for very low SNR input data, using a polarity sampling technique; (2) comparing the performance of the polarity coincidence detector with other detectors; and (3) indicating the additional SNR enhancement that may be obtained with more quantization levels. P.V.E.

N64-32274 American Meteorological Society, Boston, Mass.
THEORETICAL DETERMINATION OF THE ISOTOPE SHIFT IN THE SPECTRUM OF THE CARBON ATOM [TEORETICHESKOE OPREDELENIE IZOTOPICHESKOGO SMESHCHENIIA V SPEKTRE ATOMA UGLERODA]
A. P. Iutsis, A. S. Nakonechnyi, and G. K. Tsiunaitis Bedford, Mass., AFCRL, Aug. 1963 11 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 25, no. 6, 1953 p 683–687
(Contract AF 19(604)-6113)
(TR-406; AD-600889)

An expression was found for the specific shift in the cases of $1s^2 2s^2 2p^k 3s^{2-k} (k = 1, 2)$ configurations of the carbon atom in the two-configuration $1s^2 2s^2 2p^k 3s^{2-k} - 1s^2 2p^{k+2} 3s^{2-k}$ approximation. Using one-electron wave functions of Hartree's self-consistent field, the isotope shift of the lines of $1s^2 2s^2 2p3s - 1s^2 2s^2 2p^2$ transition in the carbon atom has been determined in both one-configuration and two-configuration approximations. The theoretical results are compared with the experimental data for the $^1P - {}^1S$ line. Author

N64-32275 American Meteorological Society, Boston, Mass.
MEASUREMENT OF FLUORESCENCE DURATION WITH A PHASE FLUOROMETER [IZMERENIE DLITEL'NOSTI FLUORESTSENTSII NA 'FAZOVOM FLUOROMETRE']
M. D. Galanin Bedford, Mass., AFCRL, Sep. 1963 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 73, no. 5, 1950 p 925–927
(Contract AF 19(604)-6113)
(TR-413; AD-600887)

Using photoelectric methods and a determination of phase shift between high-frequency photocurrents as a basis for a fluorometric device, a more direct measurement of fluorescence quenching time is reached. The accuracy of the measurement is a function of the signal-to-noise ratio. If the fluoroscence is sufficiently bright, the device can measure Δx within an accuracy of ± 3 cm. To increase accuracy and to measure small intensities, the amplifier frequency band of the device must be narrowed. A.W.

N64-32282 Michigan U., Ann Arbor Electron Physics Lab.
BASIC RESEARCH IN MICROWAVE DEVICES AND QUANTUM ELECTRONICS Quarterly Progress Report No. 1, May 1-Aug. 1, 1963
H. K. Detweiler, M. E. El-Shandwily, G. Hok, J. C. Lee, J. E. Rowe et al Sep. 1963 57 p refs
(Contract NObsr-89274)
(Rept.-05772; AD-420556)

A preliminary survey of the physical principles and phenomena that would most likely lead to the development of new ideas for the generation and amplification of coherent electromagnetic energy in the millimeter and submillimeter wavelength region is given. The analysis of the feasibility of frequency multiplication by means of passing a fast cyclotron wave into a magnetron-type cavity is given in some detail. Experimental work on extending the technique for brazing beryllium oxide to helices designed to work at frequencies of 30 Gc and higher is reported here. A nonlinear analysis of simultaneous amplification of two input frequencies by a traveling-wave amplifier is given here in detail. Very complex equations for the interaction process are obtained due to the nonlinear nature of the interaction, which gives rise to a cross modulation of the two input frequencies. Several approximations are introduced in order to simplify the analysis. Author

N64-32283 Oak Ridge National Lab., Tenn.
CORRELATED ENERGY AND TIME-OF-FLIGHT MEASUREMENTS OF FISSION FRAGMENTS
W. E. Kiker (Ph.D. Thesis–Tenn. U.) Oct. 1964 93 p refs
(Contract W-7405-ENG-26)
(ORNL-3692) OTS: $2.00

Experimental techniques and data analysis methods are given for the simultaneous measurement, using a solid state detector, of the energy and time-of-flight of single fission fragments. Considering binary fission, quantitative results are obtained for fragment kinetic energy distribution, mass distribution and average neutron yield, and average fragment kinetic energy as a function of fragment mass. A new time-of-flight calibration method that does not require delay cables was developed. The new technique uses heavy ions accelerated to energies of 30 to 100 MeV, separated into groups of known velocities, and passed through the apparatus. The spectrum

obtained from these artifficial fragments, together with the velocity spectrum from the spontaneous fission of ^{252}Cf obtained at the same time, provides a universal calibration tool. The good agreement between this work and other experiments indicates that the linear mass dependence of energy vs pulse height is valid over the range of fission-product masses. M.P.G.

N64-32300 Argonne National Lab., Ill. Idaho Div.
DOPPLER EFFECT MEASUREMENTS, SODIUM VOID COEFFICIENTS, AND CRITICAL STUDIES OF A 5,000-LITER FAST POWER BREEDER REACTOR BY THE TWO-ZONE METHOD (ZPR-III ASSEMBLY 43)
J. M. Gasidlo, J. K. Long, and W. P. Keeney May 1964 44 p refs
(Contract W-31-109-ENG-38)
(ANL-6838) OTS: $1.00

The central zone and the low-density axial blanket were designed to simulate a large power-breeder reactor. Criticality was achieved by an annular driver, while an interposed buffer modified the spectrum of the neutrons diffusing from the driver to the central zone. Experiments included sodium void coefficients for central substitutions and for full-length axial measurements. Other reactivity measurements included central reactivity coefficients and core-length column substitutions in the central zone and the annular driver. Spectral indices were measured, and reaction-rate traverses and activation experiments were performed. The reactivity change due to the doppler effect caused by heating a large, depleted, uranium oxide sample was also determined in the experimental program. Author

N64-32307 Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIGHT DIFFRACTION BY ULTRASONIC WAVES AS A MULTIPLE SCATTERING PROCESS. TECHNICAL REPORT: PHYSICS
H. V. Hance Jul. 1964 62 p refs
(Rept.-6-74-64-35)

A method of analysis has been developed that allows numerical computation for arbitrarily specified conditions to be carried out on a digital computer. This method, which employs approximate theory and an iterative process, is used in this study to investigate the ultrasonic diffraction effect over a wide range of conditions. When the ratio of light wavelength to ultrasonic wavelength is small compared to unity, the theoretical development on which this numerical analysis is based shows that the intensities in the various diffraction orders are determined by three nondimensional parameters. These parameters are related to three physical parameters of the ultrasonic beam—wavelength, intensity, and width—and two physical parameters of the light beam—wavelength and incidence angle. Author

N64-32373 Naval Ordnance Lab., Corona, Calif.
SPECTRAL EMITTANCE OF SOLIDS. SPECTRAL EMITTANCE MEASUREMENTS ON SOME COMMERCIAL OPAQUE AND TRANSPARENT SOLIDS
D. L. Stierwalt, D. D. Kirk, and J. B. Bernstein 1 Feb. 1963 8 p ref
(NOLC-TM-43-14; AD-442866)

Data are presented on the spectral emittance of some commercial transparent and opaque solids that are of interest for infrared applications. The opaque solids are called "blacks" because of their high emittance in the wavelength region examined. They were applied to aluminum surfaces before examination. Their spectral emittance is shown at 50° C. Spectral emittance of transparent solids "Irtran I" and "Irtran II" is shown as measured at 60°, 120°, and 180° C. Absorption coefficients are also shown. Spectral-emittance data at 50° C of three samples of glasses are also shown. A.W.

N64-32383* Massachusetts Inst. of Tech., Cambridge
STIMULATED BRILLOUIN SCATTERING IN LIQUIDS
E. Garmire and C. H. Townes Repr. from Appl. Phys. Letters, v. 5, no. 4, 15 Aug. 1964 3 p refs
(Grant NsG-330; Contract AF 19(628)-4011)

The stimulated Brillouin scattering of a giant-pulse ruby laser beam in liquids generated intense hypersonic acoustic waves without any damage effect, and was used to measure hypersonic velocity in liquids with high accuracy. The lightwaves were generated backward to the laser cavity, amplified, and again entered the liquid, leading to multiple-order stimulated Brillouin scattering by high-order processes within the liquid and without further amplification of the first-order wave. From the measured frequency shift, the hypersonic acoustic velocity of the liquid can be found by an equation. G.G.

N64-32412 Stanford U., Calif. Stanford Linear Accelerator Center
EMPIRICAL PARTIAL WAVE ANALYSIS OF $\pi + p$ ELASTIC SCATTERING ABOVE 1 GeV/c
Martin L. Perl and Mary C. Corey May 1964 78 p refs Submitted for Publication Supported in part by AEC and ONR
(SLAC-PUB-28; AD-602177) OTS: $3.00

A partial wave equation

$$d\sigma/d\Omega = \left|[1/2ik] \sum_{l=0}^{L} (2l + 1)(1 - a_l)P_l(\cos\theta)\right|^2$$

was used to fit most of the recent $\pi+p$ differential cross section measurements above 1 GeV/c. The a_l were determined by the method of weighted least squares, with the further requirement that they be real and that they satisfy either constraints of the form $1 \geq 1 - a_l \geq 0$ (which allows the scattering to be interpreted as purely absorptive) or the more relaxed constraints $2 \geq 1 - a_l \geq 0$. This equation with the requirements does not allow the scattering amplitude to have a spin-flip part or a real part, but for one set of data further terms were added to allow these additional parts of the scattering amplitude. For each differential cross section at the various energies, a set of a_l values was determined that in almost all cases fit the measured cross sections quite well. Author

N64-32413 Brown U., Providence, R.I. Div. of Engineering
THE ATTENUATION OF ACOUSTIC WAVES IN A TWO-PHASE MEDIUM
Joseph C. F. Chow May 1963 28 p refs Prepared for Hercules Powder Co.
(Contract NOrd-16640)
(ABL/X96; AD-602622) OTS: $2.00

A study is made of the attenuation of acoustic waves by a suspension of fluid droplets in a fluid medium. Special attention is given to the case of small droplets for which the effect of the surface tension is not negligible. The droplets are allowed to execute large translational motion and to undergo a small deformation from a spherical shape. It is shown that the result of Epstein and Carhart on the attenuation of sound waves in a gas with the suspension of liquid droplets is applicable even when the displacement of the droplet is large compared to its radius. The effect of surface tension is to increase sound attenuation in two-phase medium by increasing the thermal dissipation. This effect is important in the suspension of gaseous bubbles in liquid for small droplets and is negligible in the case of a gaseous medium containing liquid droplets. Author

N64-32430* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
g_J OF THE (5s5p) $^3P_1$ LEVEL OF Cd AND THE (6s6p) $^3P_1$ LEVEL OF Hg BY HIGH-FIELD DOUBLE RESONANCE
R. Kohler and P. Thaddeus (Columbia U.) Repr. from the Phys. Rev., v. 134, no. 5A, 1 Jun. 1964 p A1204–A1209 refs
(Contract Nonr-266(45))
(NASA-RP-332)

An optical double resonance experiment at high magnetic fields was determined of G_J for the $(5s5p)\ ^3P_1$ level of the even cadmium isotopes to be 1.499846(13), and G_J for the $(6s6p)\ ^3P_1$ level of the even mercury isotopes to be 1.486094(8). Resonance was observed in all cases at a frequency of exactly 24 Gs/sec, and magnetic fields near 11 430 G. At these high fields the Zeeman energy is of the order of 10^{-3} of the fine structure separations of the triplet terms of the (*nsnp*) configuration, and the $\Delta m = \pm 1$ transitions are split by 9.51(7) G for Cd, and by 2.99(7) G. for Hg. This splitting represents several linewidths in the case of Hg, and many linewidths in that of Cd. The average field of the two $\Delta m = \pm 1$ transitions, however, determines G_J to high precision independent of second-order corrections. Author

N64-32435* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANGLE-OF-ATTACK CONVERGENCE OF SPINNING BODIES ENTERING PLANETARY ATMOSPHERES AT LARGE INCLINATIONS TO THE FLIGHT PATH
Murray Tobak and Victor L. Peterson Washington, NASA, Oct. 1964 21 p refs
(NASA-TR-R-210) OTS: $0.50

An analysis is made of the angle-of-attack history of a spinning body entering a planetary atmosphere at an arbitrarily large inclination to the flight path. An asymptotic solution for the resultant angle-of-attack is derived, applicable to any axially symmetric body having an aerodynamic restoring-moment coefficient proportional to the sine of the resultant angle-of-attack. The solution yields results in satisfactory agreement with results obtained from numerical integrations of the exact equations of motion. Author

N64-32450 Israel Inst. of Technology, Haifa
INEQUIVALENCE THEOREM IN QUANTUM FIELD THEORY Scientific Report No. 8
A. Peres 23 Jun. 1964 11 p refs
(Contract AF-EOAR-64-20)
(ARL-64-169; AD-605475)

Lagrangians that differ by a four-divergence may lead to physically inequivalent theories. For instance, it is shown that the interaction $J^m(x)A_{,m}(x)$ gives nonvanishing fourth order Feynman diagrams. This fact has several important consequences. In particular, the various photon propagators that differ by terms of the type $k_a k_b f(k^2)$ are physically inequivalent. Author

N64-32487* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
REGULARIZATIONS OF THE PLANE RESTRICTED THREE-BODY PROBLEM
R. Broucke 28 Feb. 1964 18 p refs
(Contract NAS7-100)
(NASA-CR-59065; JPL-TR-32-626) OTS: $1.00 fs, $0.50 mf

It is shown that the two nonessential but removable singularities of the plane circular restricted three-body problem can be removed simultaneously by a coordinate transformation, which is defined by the conformal mapping $Z = 1/4(\zeta^n + 1/\zeta^n)$, where n is any finite and nonzero real number. Another regularization is obtained by the mapping $Z = 1/2 \cos n\zeta$, which is related to the preceding one by substituting $e^{i\zeta}$ for ζ. Author

N64-32515 Little (Arthur D.) Inc., Cambridge, Mass.
RADIATION ACTIVATION OF PARA–ORTHO HYDROGEN CATALYSTS Quarterly Progress Report, Mar.–May 1964
Amos J. Leffler Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Jun. 1964 18 p refs
(Contract AF 33(615)-1362)
(QPR-2; AD-449210)

A detailed calculation is given for the theoretical rate of conversion of para–ortho hydrogen caused by a paramagnetic ion on the surface of a catalyst. The calculation shows that the expected rate is orders of magnitude greater than that actually observed, and the reasons for the difference are discussed. An experimental design was carried out to improve the ADL-1 catalyst developed earlier. The results to date have not shown any improvement over available catalysts. Author

N64-32536 Brown U., Providence, R.I. Div. of Applied Mathematics
MULTIPOLAR CONTINUUM MECHANICS: FUNCTIONAL THEORY.
A. E. Green and R. S. Rivlin (California U.) Jul. 1964 67 p refs
(Contracts Nonr-562(10); Nonr-522(81))
(TR-92; AD-603439)

A general theory of force and stress multipoles previously presented by the authors is developed further by discussing constitutive equations in terms of functionals involving both space and time. Both nonsimple fluids and nonsimple materials of both the space differential type and the space functional type are considered. The restrictions on the form of the constitutive equations due to material symmetry are discussed, a relation between nonsimple fluids of the space functional and space differential types is established, and special cases of nonsimple fluids of the space differential type are discussed. The corresponding work for simple materials is considered briefly, and a linear theory of nonsimple materials is derived. M.P.G.

N64-32554 Chicago U., Ill. Lab. of Molecular Structure and Spectra
[ANALYTICAL STUDIES OF DIATOMIC MOLECULES] Quarterly Status Report, 1 Apr.–30 Jun. 1964
C. C. J. Roothaan [1964] 8 p refs
(Contract DA-11-022-ORD-3119; ARPA Order-368)
(QSR-20; AD-445678)

Research activities dealing with the following are discussed: (1) analytical atomic self-consistent-field (SCF) program, homonuclear and heteronuclear diatomic SCF programs, and the atomic and molecular integrals package program; (2) theoretical developments and calculations on atoms (comparison of a fully coupled method of calculating the electric dipole polarizabilities with other calculations); (3) accurate calculations on H_2 and HeH^+ molecules; (4) Hartree–Fock calculations and the electronic structure of diatomic molecules; and (5) one-center-expansion SCF calculations on NH and NH_2 molecules. P.V.E.

N64-32562 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
LOW-FREQUENCY APPROXIMATIONS FOR SCATTERING BY DIELECTRIC ELLIPTIC CYLINDERS
J. E. Burke 2 Jul. 1964 27 p refs
(Contract DA-36-039-AMC-03404(E))
(EDL-M725; AD-448713)

The Mathieu function series solution for the scattering of a plane wave by a dielectric elliptic cylinder is used to obtain explicit low-frequency (long wavelength) approximations in powers of the frequency. The far-field scattering amplitude is given to the sixth power of the frequency, and the external and internal fields are given to the third power. Arbitrary angles of incidence and observation, and arbitrary eccentricity are considered. Author

N64-32600 Naval Research Lab., Washington, D.C.
FORTY YEARS OF RESEARCH FOR THE NAVY, 1923–1963. Annual Report, 1963
[1963] 52 p
(AD-448760)

Research activities in the following areas are briefly outlined: applications research; atmosphere and astrophysics; chemistry; electronic devices; mechanics; metallurgy and ceramics; nuclear and atomic physics; optics; radio; research computation center; solid-state physics; and sound. P.V.E.

N64-32624 Illinois U., Urbana Antenna Lab.
DESIGN AND OPERATION OF A RADIATING LENS FED BY A GOUBAU BEAM-WAVEGUIDE
P. E. Mast, M. Fournier, and J. F. Kauffman Jul. 1964 37 p refs
(Contract AF 33(657)-10474)
(TR-80; AD-603552)

Some of the problems associated with extending the electromagnetic spectrum to submillimeter wavelengths can be overcome by using a Goubau electromagnetic beam waveguide. The problem of efficiently coupling energy between the guiding system and free space in this new type of waveguide is investigated. A coupler consisting of dielectric lenses is considered. The Goubau waveguide is used as a feed line. The design of a coupler to modify the field distribution so as to illuminate a large radiating lens is determined using a geometrical optics approach. This approach is justified as a first approximation since the dimensions of the elements in the guiding section, as well as those in the coupling system, are very large compared to a wavelength. M.P.G.

N64-32630 Pennsylvania State U., University Park Ionosphere Research Lab.
CHARACTERISTIC VALUES FROM A NEW APPROACH TO PHASE INTEGRAL APPROXIMATION Scientific Report No. 219
K. M. Hagenbuch 10 Sep. 1964 43 p refs
(Contract AF 19(628)-4014)
(AFCRL-64-638; AD-606645)

The wave equation and a square integrability condition on allowable solutions, both transformed to a first-order nonlinear system, are used to produce phase integral approximations to quantization conditions for bound-state quantum mechanical problems. Author

N64-32636* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
POTENTIAL ADVANTAGES OF ANISOTROPIC SUPERCONDUCTORS IN "FORCE-FREE" SOLENOIDS
Edmund E. Callaghan Washington, NASA, Oct. 1964 12 p refs
(NASA-TN-D-2156) OTS: $0.50

An analysis is made of the use of Type II (hard) superconductors in a force-free infinite solenoid. Force-free conditions are achieved by a linear variation of helical pitch angle across the winding thickness going from a longitudinal current at the inner winding to an azimuthal current at the outer winding. The force-free condition, that is, current path aligned with local magnetic field, also permits the maximum critical current to be carried in the windings, since type II superconductors carry much higher critical currents in parallel as opposed to transverse magnetic fields. The overall result showed a considerable increase in axial magnetic field for force-free solenoids as compared with the usual (zero pitch) winding techniques. Author

N64-32673 Michigan U., Ann Arbor Infrared and Optical Sensor Lab.
STUDIES IN SPECTRAL DISCRIMINATION
R. R. Legault, J. F. Riordan, R. Lyjak, W. Richardson, J. Penquite et al Sep. 1964 48 p refs
(Contract AF 33(657)-10974)
(Rept. – 5698-1-T; AD-447392)

This report includes an evaluation of the application of the infrarimetry concept to spectral discrimination, and describes a theoretical analysis of the general subject of spectral discrimination. The theoretical analysis includes development of a technique for statistical spectral discrimination. Author

N64-32674 Michigan U., Ann Arbor Optical and Radio Systems Lab.
INVESTIGATION OF PRECISION POSITION DETERMINATION BY DISTANCE-MEASURING TECHNIQUES
Russell A. Rollin, Jr., Hodge W. Doss, Jr., Elmer H. Smith, and Randall E. Cline Aug. 1964 85 p refs
(Contract DA-36-039-SC-78801; Proj. Michigan)
(Rept. 2900-453-T; AD-445290)

An exploratory investigation study and analysis of precision position determination by distance-measuring techniques has been conducted. This report reviews physical principles, electronic methods, and modern oscillators as they apply to real-time coordination in relative frameworks. A quadrangulation system is proposed and formulated as a mathematical model on an LGP-30 computer. The model includes a preliminary error analysis. A balanced experimental and analytical program is outlined toward realization of very precise position determination, in order to impose implicit calibration upon signals that have undergone atmospheric refraction. Author

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-31472 Princeton U., N.J. Plasma Physics Lab.
POWER BALANCE IN HELIUM DISCHARGES IN THE C STELLARATOR
A. S. Bishop, A. Gibson, E. Hinnov, and F. W. Hofmann May 1964 50 p refs
(Contract AT(30-1)-1238)
(MATT-268)

Power balance measurements have been carried out for helium discharges in the C-Stellarator over a wide range of ohmic heating currents. The results show that the power input can be satisfactorily accounted for in terms of power dissipated in radiation, ionization, and heating of the helium. Power loss due to impurity radiation is negligible; that due to charge exchange is shown to be insignificant (except possibly at very low currents). Other mechanisms of power loss appear to play no major role in the power balance analysis. Author

N64-31565* National Aeronautics and Space Administration. Washington, D.C.
SOME PROBLEMS ON UNSTEADY FLOW OF A VISCOUS ELECTRICALLY-CONDUCTING FLUID IN A MAGNETIC FIELD [NEKOTORYYE ZADACHI O NEUSTANOVIVSHEMSYA DIVZHENII VYAZKOY ELEKTROPROVODNOY ZHIDKOSTI V MAGNITNOM POLE]
V. P. Shidlovskiy Sep. 1964 15 p refs Transl. into ENGLISH from Revue de Mecanique Appliquee, v. 8, no. 5, 1963 p 757–767
(NASA-TT-F-9105) OTS: $1.00 fs; $0.50 mf

Two cases of unsteady flow of a viscous, incompressible, electrically conducting fluid in a magnetic field are investigated. The first case is associated with the flow of a fluid around an infinite cylinder that suddenly starts to rotate at a constant angular velocity when $t = 0$. At the same time, the magnetic field is stationary and has components H_r and H_z. In the second case, a study is made of axial flow of a fluid between two concentric cylinders in a steady magnetic field and acted upon by a pressure gradient, assuming that the constant pressure gradient dp/dz is applied sharply at the time $t = 0$. In both cases the magnetic field considerably increased the resistive forces and increased the duration of the unsteady phenomenon. Author

N64-31619 Arkansas U., Fayetteville Plasma Lab.
RESEARCH ON THE INTERACTIONS OF PLASMA FLOW AND MAGNETIC FIELDS Quarterly Progress Report, Feb. 15–May 15, 1964
Denys O. Akhurst [1964] 21 p
(Contract DA-23-072-AMC-168(Z))
(UAPL-15; AD-447800)

Theoretical and experimental work in magnetohydrodynamics and superconductivity is reported in the following areas: (1) equipment status; (2) instrumentation for plasma-characteristics measurements (conductivity and jet velocity); (3) studies of the electric field induced from plasma interaction with a magnetic field, including the interaction of a plasma ring with a current loop; (4) plasma conductivity studies, including tabulated values of collision cross sections and some numerical results for the conductivity of ionized gases; (5) impedance vs frequency characteristics of dc plasma; and (6) superconducting energy-transfer studies. M.P.G.

N64-31641 Massachusetts Inst. of Tech., Cambridge
EXPERIMENTS ON A QUASI-STEADY J x B ACCELERATOR
R. Leon Leonard and James A. Fay Apr. 1964 42 p refs Presented at the Fifth Symp. of Eng. Aspects of Magnetohydrodynamics, Cambridge, Mass., 1–2 Apr. 1964 Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(MIT-33-P; AD-436604)

Experiments have been conducted on the acceleration of partially ionized argon in a channel of constant cross-sectional area having a uniform applied transverse magnetic field and subject to a current normal to both magnetic field and channel axis. The channel was operated in the manner of a shock tunnel with sufficient test time to achieve steady flow within the accelerator section. Visual observation of the flow within the channel and measurement of the electrical characteristics of the driving circuits established that substantial acceleration occurred in the channel. Measurements were made of the electrode potential and current and of the applied magnetic field. Author

N64-31800 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMODYNAMIC PROPERTIES OF ARGON AT HIGH TEMPERATURES
V. V. Rybakov 27 Aug. 1964 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Neft' i Gaz (USSR), no. 5, 1963 p 77–80
(FTD-TT-64-461/1; AD-605803)

Methods of statistical physics and thermodynamics were used. The sum in accordance with the inner state was determined in order to compute the constants of the ionization equilibrium and the thermodynamic functions of the ionized gas and its mixtures. R.L.K.

N64-31806 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
ION DISSOCIATION IN THE DRIFT TUBE OF A TIME-OF-FLIGHT MASS SPECTROMETER. III: FLIGHT-TIME SHIFT EQUATIONS FOR SPURIOUS FRAGMENT PEAKS ARISING FROM CHARGE TRANSFER AND DISSOCIATION REACTIONS OCCURRING INSIDE THE POTENTIAL BARRIER Physical Sciences Research Papers No. 30
W. W. Hunt, Jr. Jun. 1964 14 p refs
(AFCRL-64-519; AD-605811)

Spurious fragment peaks that simulate fragment-ion products of ion dissociation reactions occurring in the reaction region can arise from processes that occur after the reactant ion has passed through the reaction region and entered the potential barrier used to separate normal products and reactants. Analytic expressions for the flight-time shifts characteristics of peaks arising in this way are derived. These flight-time shifts depend on the distance from the ion source to the potential barrier, whereas flight-time shifts for true fragments formed in the reaction zone are independent of this distance. Author

N64-31910 Microwave Associates, Inc., Burlington, Mass.
NANOSECOND-PULSE BREAKDOWN STUDY AT MICROWAVE FREQUENCIES Final Report
C. Buntschuh and M. Gilden Griffiss AFB, N.Y., RADC, Jul. 1964 50 p refs
(Contract AF 30(602)-2782)
(RADC-TDR-64-204; AD-603818)

Microwave breakdown of gases was studied under short-pulse conditions. An experimental technique was developed for generating and measuring high-power 10 nsec pulses at X-band frequencies. Breakdown times were in the range of 2 to 10 nsec and values of E/p extended to 10^4 V/cm-torr. Normalized breakdown curves for air, nitrogen, helium, Freon 12, SF_6, Freon C318, and Freon 114 were obtained and compared to theoretical estimates. The agreement was good. Comparison of these results with published breakdown data obtained with nanosecond video pulses enabled values of electron collision frequency to be calculated for air, helium, and nitrogen at large values of E/p. For electron-attaching gases it was found that some mechanism provided initial ionization and also affected the breakdown threshold. Author

N64-31947 Cornell U., Ithaca, N.Y. Electrical Engineering Research Lab.
INVESTIGATION OF LINEAR BEAM AND NEW CONCEPTS OF MICROWAVE POWER GENERATION Third Quarterly Progress Report
G. C. Dalman and L. F. Eastman Griffiss AFB, N.Y., RADC, Aug. 1964 82 p refs
(Contract AF 30(602)-3243)
(RADC-TDR-64-278; AD-606635)

Noise-growth data, obtained from a shielded-gun beam tester, were compared to previously obtained reminiscent peak velocity data. The efficiency of multicavity klystrons was enhanced by application of direct-current bias to the electron beam, with quite sensitive tube behavior to magnetic focusing variations. Theoretically determined optimum efficiency for a two-cavity klystron proved highest for a gridless double-gap case. Direct-current beam and plasma measurements were obtained by a plasma analyzer, and the scattering effect on the beam and the radial plasma profile is discussed. In formation of an electron beam, using laser-stimulated emission, a pulsed magnetic field was used to focus electrons by an indirect emission gun through a 5-mil hole, and a simple theory was formed for the beam admittance. G.G.

N64-31987 Microwave Associates, Inc., Burlington, Mass.
STUDY OF PLASMA AMPLIFIERS Scientific Report No. 1
J. Coccoli 29 Feb. 1964 90 p refs
(Contract AF 19(628)-452)
(AFCRL-64-445; AD-606137)

A combined theoretical and experimental program to investigate several fast-wave interaction mechanisms between microwave radiation and a plasma or electron gas in a uniform magnetic field is described. A comparison is made between the interaction predicted by Bekefi, Hirshfield, and Brown based on the minute relativistic mass change of an electron with a change in velocity of the electron and the prediction and observations of Chow and Pantell based on the phase change between the oscillating electric field and the cyclotron motion of the electron due to "radiation pressure" on the electron. An "average electron" model is presented; this model is applicable to the situation of electrons in a rectangular waveguide. The model predicts the predominance of the relativistically dependent mechanism as the phase velocity of the wave approaches infinity, e.g., the situation at waveguide cutoff. Author

N64-32032 Army Missile Command, Huntsville, Ala. Physical Sciences Lab.
GAS VELOCITY PROBE FOR MOVING IONIZED GASES
Charles Cason 5 Aug. 1964 23 p refs
(RR-TR-64-7; AD-447378)

A direct electrical method for measuring the velocity of a flowing plasma has been investigated. It is based upon the polarization voltage induced when a plasma flows transverse to an applied magnetic field. A method has been developed to allow the estimation of certain background signals and the determination of allowable measurement currents due to plasma properties. Two methods of collecting data were tested on a plasma jet, and comparisons were made. Author

N64-32069 MHD Research, Inc., Newport Beach, Calif.
EXPLOSIVE MAGNETOHYDRODYNAMICS First Quarterly Technical Progress Report, 1 Apr.–30 Jun. 1964
Malcolm S. Jones, Jr. and Francis H. Webb, Jr. 13 Jul. 1964 47 p refs
(Contract AF 33(615)-1594)
(MHD-655; AD-602811) OTS: $2.00

Experimental and theoretical studies on the production of high-energy, short-duration pulses of electrical power by MHD principles are discussed. Previous work in a 1- by 1-in. cross section channel and a 1- by 4-in. cross section channel using cesium-seeded condensed explosives, which produced tens of megawatts of electrical power in pulses of approximately 100μ sec, is expanded. A program for a 2- by 6-in. cross section linear channel and for a radial geometry generator is discussed. Power generation appears to be proportional to the square of the velocity of the conducting front. Lumped-parameter circuit-theory analyses are presented, and expressions are derived that may be used to determine the amount of energy removed from the slug as a function of distance along the channel, and the generator geometry. Author

N64-32110 Air Force Cambridge Research Labs., Bedford, Mass.
TRANSIENT REFLECTION AND TRANSMISSION OF A PLANE WAVE NORMALLY INCIDENT UPON A SEMI-INFINITE ANISOTROPIC PLASMA Physical Sciences Research Papers No. 33
Carl T. Case Jul. 1964 36 p refs
(AFCRL-64-550; AD-606559)

General solutions for the transmitted and reflected waves in integral form are obtained for a plane wave of arbitrary time dependence, normally incident upon a semi-infinite, cold, collisionless, homogeneous, anisotropic ionized medium. The special case of an isotropic plasma with an incident wave of harmonic time dependence is also investigated. Author

N64-32136 Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center
LONG LIFE CLOSED LOOP MHD RESEARCH AND DEVELOPMENT UNIT Interim Scientific Report, 15 Jun.–15 Sep. 1963
E. V. Somers, R. L. Hundstad, R. E. Voshall, J. G. De Steese, F. A. Holmes et al Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab. [1963] 58 p refs
(Contract AF 33(657)-8311)
(ISR-6; AD-420060)

The effect of wall friction and heat transfer on MHD devices has been examined, and the key parameters affecting the efficiency are given. A Reynold's analogy was used to study the effect of heat transfer. Photoionization has been proposed as a means of ionizing the gas in the MHD duct. An experiment was devised to measure the electrical conductivity of a Cs vapor that is ionized by ultraviolet radiation from commercial mercury lamps. Author

N64-32138 Stanford Research Inst., Menlo Park, Calif.
THE USE OF ION PROBES FOR DIAGNOSING RE-ENTRY PLASMAS
W. C. Taylor Jul. 1963 40 p refs
(Contract ARPA-SD-103; ARPA Order 281-62)
(TR-11; AD-420827)

This report details a laboratory investigation into the use of wire probes for determining electron density in plasmas formed by hypersonic shock waves in air. The report discusses the simpler relations used to interpret the data in terms of plasma parameters over a wide range of pressures. The report describes the experiments, lists the results, and discusses the errors involved. Most of the measurements were made in an electromagnetic shock tube, where microwave transmission measurements were used as an independent check on electron density. A discussion is given of several special topics associated with the probe, such as flow velocity effects, bias levels, ion versus electron collection, probe shapes, contamination, and thermionic emission. Author

N64-32153 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
RESEARCH IN MHD POWER GENERATION Semiannual Report, 1 Jan.–30 Jun. 1963
Arthur Sherman [1963] 134 p refs
(Contract Nonr-3867(00); ARPA Order 325–326)
(SAR-2; AD-421896)

Various experimental techniques required for obtaining useful magnetohydrodynamics (MHD) data were perfected. Earlier reported data were extended, and it was established that magnetically induced ionization existed in an MHD generator. Work on barium diodes revealed that barium attacks alumina severely. Boron nitride also proved to be actively attacked by barium. Further studies on the ejector gas cycle, on the basic mechanisms of metastable ionization, and on the influence of magnetically induced ionization on the MHD flowfield are reported, as is the status of the closed-loop MHD experiment. D.E.W.

N64-32159 Elcon Lab., Inc., Peabody, Mass.
INTERACTION OF ELECTROMAGNETIC WAVES AND CLASSICAL PLASMAS Interim Engineering Report No. 2
10 Jul. 1964 62 p refs
(Contract AF 33(657)-11671)
(R-7-64-1; AD-447813)

The crossed-beam, cross modulation plasma diagnostic technique is examined on the basis of the distribution function theory and the Boltzmann equation. The results show that several plasma properties (notably, electron density and collision frequency profiles) may be accurately measured for volumes as small as 0.01 cm ^{3}. Author

N64-32273 Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
SLOW VISCOUS MHD FLOWS ABOUT MAGNETIZED SPHERICAL BODIES
Vivian O'Brien Jun. 1964 28 p refs
(Contract Now-62-0604-c)
(CM-1047; AD-447391)

Axisymmetric aligned MHD viscous flows about magnetized bodies are discussed in terms of Stokes stream function and a corresponding magnetic flux function. The first-order MHD fields of a number of magnetized spheres have been calculated. Some cases are previously published results reevaluated by this more convenient method. The analysis can be extended to other bodies and other magnetic configurations. Author

N64-32276* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE SHAPE OF A MAGNETICALLY ROTATED ELECTRIC ARC COLUMN IN AN ANNULAR GAP
James R. Jedlicka Washington, NASA, Oct. 1964 23 p refs
(NASA-TN-D-2155) OTS: $0.75

An electric arc discharge whirled in the annular gap between concentric, cylindrical electrodes by an external axial magnetic field is analyzed. A simplified model of the system is chosen, such that the arc is replaced by an impenetrable, conducting cylinder moving in a uniform fluid. At equilibrium the arc axis assumes a shape in which the driving electromagnetic force balances the retarding fluid-dynamic force. The equation for the shape is demonstrated to be the involute of a circle. For large magnetic field strengths, diffuse-discharge operation is predicted. Comparison with experiment is good. The interpretation of arc photographs is discussed. Author

N64-32292 Dewey (G.C.) Corp., New York, N.Y.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF RADIATION ON THE PROPAGATION OF ELECTROMAGNETIC SIGNALS IN AIR Final Technical Report
M. N. Hirsh and P. N. Eisner Ft. Monmouth, N.J., Army Signal Res. and Develop. Labs., Applied Physics Div., 30 Jun. 1963 129 p refs
(Contract DA-36-039-SC-87318)
(R-146-8; AD-442885)

A technique has been developed for measuring thermal electron processes in dilute gaseous plasmas in both steady-state and transient experiments. The 1.5-MeV electrons from a Van de Graaff accelerator irradiate the gas uniformly, producing ions and secondary electrons that are rapidly thermalized by collisions with neutral molecules. The gas is contained in a 710-liter cylindrical rf cavity resonant in the TE_{011} mode at 390 Mc/sec, to permit uhf measurements of the resulting free-electron density. The large cavity volume minimizes the role of the walls in the diffusive removal of charged particles and in the contribution of impurities to the gas. Measurements performed in oxygen, nitrogen, and air are described. Author

N64-32321 Northorp Corp., Hawthorne, Calif. Northrop Space Labs.
EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS OF CROSSED-FIELD PLASMA ACCELERATORS Ninth Monthly Technical Progress Report, 1–31 Jan. 1963
S. T. Demetriades [1963] 7 p
(Contract AF 33(657)-8558)
(NSL-62-113-9; AD-442753)

Installation, preparation for testing, and preliminary tests are reported of an accelerator having three water-cooled electrode pairs, an accelerator having four uncooled tungsten electrode pairs, and an accelerator having four water-cooled electrode pairs. Results are shown in tabular summary. A.W.

N64-32341 Innsbruck U. (Austria) Institute for Theoretical Physics
SOME PRACTICAL EXAMPLES OF ONE DIMENSIONAL UNSTEADY POTENTIAL FLOWS IN MGD Scientific Report No. 11
Ferdinand Cap and Franz Herrnegger 14 Jun. 1964 20 p ref
(Contract AF 61(052)-675)

A graphical method of solving the one-dimensional unsteady potential equation in MGD is rigorously proved in equation (1). The speed of propagation of weak compression waves in a plasma is determined by the sum of the flow velocity $\hat{v}$ and wave velocity $\hat{a}^*$ in the plasma, where

$$\hat{a}^{*2} = \hat{a}^2 + \hat{V}^2 \qquad (1)$$

(where $\hat{a}$ is the sonic velocity and $\hat{V}$ is the Alfvén velocity). The wave propagation in a positive or a negative direction is given by

$$dx/dt = \bar{\hat{v}} \pm \bar{\hat{a}}^* = \cot \alpha. \qquad (2)$$

Equation (2) represents the differential equation of the Riemann lines that describe the space–time dependence of undisturbed elementary waves in the plane of flow (x, t). Author

N64-32345 Nagoya U. (Japan) Institute of Plasma Physics
ANNUAL REVIEW, APRIL 1963–MARCH 1964
1964 49 p

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N64-32348 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany) Institut für Energiewandlung und Elektrische Antriebe

SELF-EXCITATION OF AN ELECTRODELESS MHD-GENERATOR [DIE SELBSTERREGUNG EINES ELEKRODENLOSEN MHD-GENERATORS]

W. Peschka, S. Kelm, and C. Carpetis Jul. 1964 32 p refs In GERMAN; ENGLISH summary
(DVL-319; DLR-FB-64-08)

For induction generators using iron, a self-excitation is possible. Because of the iron saturation the voltage–current curve is not a straight line. An intersection point between the voltage–current curve of the generator and the voltage–current of the exciting capacitors exists, and therefore a stable self-excitation is possible. If no iron is used in the generator the voltage–current characteristic will also be curved because of the nonlinear behavior of the plasma. Some values for an electrodeless MHD-generator are calculated. Further, the self-excitation of the transmission-line generator is possible. There is a close formal analogy between the transmission line generator and the high-frequency traveling-wave amplifier. Author

N64-32349 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany) Institut für Energiewandlung und Elektrische Antriebe

THEORETICAL STUDIES OF AN ELECTRODELESS MHD-GENERATOR OF INFINITE LENGTH [DIE THEORIE DES UNENDLICH LANGEN ELEKTRODENLOSEN MHD-GENERATORS]

W. Peschka and S. Kelm Jul. 1964 47 p refs In GERMAN; ENGLISH summary
(DVL-316; DLR-FB-64-11)

The theory of the MHD-induction generator of infinite length is given for flat and symmetric cylinder geometry. MHD-induction machines were first developed for electromagnetic pumping of liquid metals. At present the deceleration or acceleration of plasma flows is very important for energy conversion and propulsion in space-flight technology. Author

N64-32395 Princeton U., N.J. Plasma Physics Lab.

RUNAWAY ELECTRONS IN AN IDEAL LORENTZ PLASMA

Martin D. Kruskal and Ira B. Bernstein Aug. 1963 47 p refs (Contract AT(30-1)-1238)
(MATT-226)

The phenomenon of electron runaway under a constant electric field is treated in the simplified model of a Lorentz gas, in which the electrons experience Coulomb collisions with infinitely massive ions only. This model permits a rigorous systematic analysis of the problem, devoid of arbitrary elements, in the limit of weak electric field. The analysis leads to a decomposition of velocity space into three regions—low, intermediate, and high. The problem is solved explicitly in the first and third regions and reduced to solving a single "universal" partial differential equation in the second region. The runaway rate, number of runaway electrons, and electric current density (average electron velocity) are obtained explicitly. Author

N64-32404* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

THREE-BODY COLLISIONAL RECOMBINATION OF CESIUM SEED IONS AND ELECTRONS IN HIGH-DENSITY PLASMAS WITH ARGON CARRIER GAS

John V. Dugan, Jr. Washington, NASA, Oct. 1964 36 p refs (NASA-TN-D-2004) OTS: $1.00

The rate of three-body recombination between cesium seed ions and electrons in an argon carrier gas is calculated for free-electron number densities of 10^{13} to 10^{18} per cubic centimeter and electron temperatures of 500° to 10 000° K. These ranges correspond to plasmas of interest for magnetohydrodynamic power generation. Only monatomic cesium ions are considered in a collisional approximation where radiative transitions are ignored. The Byron method is applied to describe collision-induced transitions between atomic energy levels by the semiclassical Gryzinski cross sections and the principle of detailed balancing. Recombination is limited by deexcitation due to superelastic collisions. Author

N64-32417 Princeton U., N.J. Plasma Physics Lab.

PLASMA DENSITY MEASUREMENTS WITH ATOMIC BEAMS

Harold P. Eubank, Peter Noll, and Fred Tappert Jun. 1964 20 p refs
(Contract AT(30-1)-1238)
(MATT-277)

A method is described for the measurement of plasma ion density, which relies upon the attenuation of a medium energy atomic beam. For beam energies of a few keV resonant charge transfer with plasma ions predominates so strongly over competing processes leading to beam attenuation that the determination of ion density is particularly simple. A 2.5 to 5-keV atomic hydrogen beam is used to measure the proton density produced by a pulsed plasma gun and by the B-1 stellarator. In the latter case a 4-mm microwave interferometer was used to confirm the calculated calibration. The time response of the system is of the order of a Mc/sec for density changes $\geq 10^{13}/cm^3$. The method appears particularly well suited for ion densities of order 10^{14}/cc where microwave measurements are difficult. Author

N64-32428* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

ELECTROMAGNETIC ACCELERATION OF A VARIABLE-MASS PLASMA

Donald J. Vargo Washington, NASA, Oct. 1964 43 p refs (NASA-TN-D-2164) OTS: $1.25

Nonlinear one-dimensional rail-accelerator equations were solved with an analog computer by treating mass as a variable. The rail mass-erosion coefficient was chosen from previously published vacuum-spark experiments. A set of nondimensional equations was constructed containing three parameters—the electromechanical interaction, the circuit damping, and the initial mass. Solutions are presented over ranges of these parameters. Energy efficiencies of 40% for the first cycle and greater than 55% for the final values were obtained for the best combination of these parameters. Author

N64-32437* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

CESIUM ION-NEUTRAL SCATTERING AND ION MOBILITY IN THE LOW FIELD LIMIT

John W. Sheldon Washington, NASA, 1964 11 p refs Presented at the IEEE Thermionic Conversion Specialist Conf., Cleveland, 26–28 Oct. 1964
(NASA-TM-X-52061) OTS: $1.00 fs; $0.50 mf

A semiclassical theory of cesium ion-neutral scattering with charge exchange is presented. The differential scattering cross section is presented and integrated to obtain total cross section and momentum-transfer cross section. The total cross section calculation gives good agreement with experiment. The momentum-transfer cross section, when compared in terms of ion mobility in the low field limit, also gives good agreement with experiment. Author

N64-32438* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
ENERGY REQUIRED FOR ION PRODUCTION BY ELECTRON BOMBARDMENT IN HELIUM, ARGON, AND CESIUM
Ronald J. Sovie and John V. Dugan, Jr. Washington, NASA, 1964 28 p refs Presented at the Am. Phys. Soc. 17th Ann. Gaseous Electron Conf., Atlantic City, 14–16 Oct. 1964
(NASA-TM-X-52064) OTS: $2.00 fs; $0.50 mf

The energy cost for ion production has been calculated for optically thin atomic helium, argon, and cesium gases by comparing the relative probabilities for the competing inelastic processes of excitation and ionization. Results were obtained for two cases: (1) a monoenergetic electron beam incident upon a cold neutral gas, and (2) the interaction of a thermal electron gas with cold neutrals. Experimental excitation cross sections were used in the helium calculations. The semiclassical Cryzinski method was used to determine theoretically the cross sections needed for the argon and cesium calculations. Author

N64-32448 Avco-Everett Research Lab., Everett, Mass.
THOMSON SCATTERING COMPUTATIONS FOR LABORATORY PLASMAS
Edward T. Gerry and Richard M. Patrick Aug. 1964 12 p ref
(Contract AF 49(638)-1129)
(RR-187; AD-603950)

This note presents some calculations of the spectrum of Thomson scattering of a laser beam from typical laboratory plasmas. These calculations are numerical results based on theoretical work by Salpeter. The results show that the character of the spectrum depends upon the ratio of the length in the plasma over which the scattered spectrum adds coherently to the debye length, α. For small a, i.e., $a < 10^{-1}$, the spectrum is simply an electron doppler-broadened spectrum. For medium α ($10^{-1} < \alpha < 1$), the spectrum shows doppler broadening due to both ions and electrons, and for large α ($1 \leq \alpha$) there are peaks in the scattered spectrum displaced from the primary laser frequency by an amount approximately equal to the plasma frequency. Author

N64-32504 Avco-Everett Research Lab., Everett, Mass.
PLASMA RADIATION SHIELDING
R. H. Levy and G. S. Janes Sep. 1964 11 p refs
(Contract AF 49(638)-659)
(RR-192; AD-448095)

A new scheme is suggested that is intended to make possible the maintenance of a space vehicle at a potential of several hundred million volts above its surroundings. Such a vehicle would be electrostatically shielded against high energy incident protons, but would attract electrons from the interplanetary plasma. The key to the maintenance of the potential is the control of these electrons by a magnetic field. The magnetic field strength required to control these electrons is far less than the strength required (as in a pure magnetic shield) to control energetic protons. As a result, engineering estimates of the weight of this device (assuming superconductors) show that it offers the possibility of substantially increased shielded volume per unit weight. Since electrons are to be kept away from the space vehicle by the magnetic field, no useful magnetic field line can intersect the surface of the vehicle. For this reason, the vehicle must be toroidal in shape so that magnetic field lines can link the hole in the center. The magnetic field is provided by a current circulating around the hole in the torus.
Author

N64-32586 Elcon Lab., Inc., Watertown, Mass.
INTERACTION OF ELECTROMAGNETIC WAVES AND CLASSICAL PLASMAS Interim Engineering Report No. 1
26 Aug. 1963 109 p refs
(Contract AF 33(657)-11671)
(R-8-63-4; AD-439831)

The crossed-beam, cross modulation microwave plasma diagnostic technique is examined on the basis of average electron theory. One microwave beam is used to heat a selected portion of a plasma. This beam is amplitude modulated and produces a modulation of the plasma conductivity. A second steady beam is directed through the plasma and, as a result of the heating produced by the first beam, is modulated. The resulting signal is dependent only on the properties of the plasma in the region of intersection of the two beams. Tables of propagation constant versus electron density and collision frequency were prepared, and expressions for the differential propagation constant were derived. Several methods for making an unambigious determination of the electron density and collision frequency are outlined. Author

N64-32612 Avco-Everett Research Lab., Everett, Mass.
MHD CHARACTERISTICS AND SHOCK WAVES
A. R. Kantrowitz and H. E. Petschek Jul. 1964 71 p refs
(Contract AF 49(638)-659)
(RR-185; AD-603951)

A review of the theory of MHD characteristics and shock waves is presented. Primary emphasis is placed on a physical discussion of the three characteristic modes and the jump conditions for the two types of shock waves that can exist. Brief discussions of shock structure, applications of the theory, and the range of applicability of the continuum equations are also given. Author

N64-32653 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PLASMA, THE FOURTH STATE OF MATTER
D. A. Frank-Kamenetskiy 4 Dec. 1962 191 p Transl. into English of the book "Plazma–Chetvertoye Sostoyaniye Veshchestva" Moscow, Gosatomizdat., 1961 132 p
(FTD-TT-62-508/1+2; AD-449750)

The book discusses the basic ideas of plasma physics from the viewpoint of a model of a continuous conducting medium (magnetohydrodynamics), as well as through consideration of the motion of the individual charged particles and their collisions (physical kinetics). The oscillations of the plasma, its instability, compression and retention by magnetic fields, and plasma acceleration are also discussed. Basic attention is devoted to the qualitative pattern of the phenomena. Formulas are given only in the simplest cases. Author

N64-32665 Avco-Everett Research Lab., Everett, Mass.
MAGNETOGASDYNAMIC EFFECTS IN THE FLOW BEHIND A SPHERE
A. Goldburg and P. O. Jarvinen Aug. 1964 35 p refs *Its* Res. Note 415
(Contract AF 04(694)-414)
(BSD-TDR-64-107; AD-606055)

Maxworthy's experiments with the flight of a sphere through an incompressible electrically conducting fluid with an aligned magnetic field showed that transition in the trailing wake was moved to higher fluid mechanical Reynolds numbers. Theoretical and experimental work on suppression of vorticity in uniformly conducting incompressible fluids with imposed uniform transverse magnetic fields is analyzed to find a correlating parameter for C_D, C_f, and transition to turbulence. The parameter that is found is the square root of the ratio of the fluid mechanical Reynolds number (R) to the electromagnetic interaction parameter (S), $\sqrt{R/S}$, for the conditions $S \approx O(1)$ a

RS>>O(1). The $\sqrt{R/S}$ is the Reynolds number based on Hartman layer thickness, $R_H = \sqrt{\rho V^2/\sigma B^2}\nu$. Extension of the incompressible problem to the compressible one is based on the observed similarity of the transition processes in the hypersonic and incompressible wakes. Author

N64-32672 Michigan U., Ann Arbor Electron Physics Lab.
APPLIED RESEARCH IN MICROWAVE AND QUANTUM ELECTRONICS Final Report, 5 Feb. 1962–5 Feb. 1964
J. E. Boers, H. K. Detweiler, G. I. Haddad, G. Hor, G. T. Konrad et al Aug. 1964 167 p refs
(Contract AF 33(657)-8050)
(AL-TDR-64-158; AD-606631)

The following areas are covered in this paper: "High Thermal Conductivity Materials for Microwave Tubes"—describing new techniques and theories for brazing a tungsten helix inside a densely sintered beryllium oxide tube to improve the thermal contact without affecting the electrical characteristics of the helix. Theoretical transient and steady-state solutions for the radial-heat-flow problems of the thermal contact between the helix and the beryllium oxide cylinder were obtained. "Low-Noise Investigations"—analysis of multivelocity low-noise streams, low-noise microwave tube theory, traveling-wave maser studies, and experimental work; "Plasmas and Quantum Electronics"—Cerenkov radiation device, millimeter-wave plasma oscillator, microwave plasma amplifier, nonlinear beam-plasma interactions, linear theory of beam-plasma interaction, and experimental determination of the optimum reflector configuration in linear-lamp pulsed lasers; "Cross-Field Electron Gun Studies"—Poisson cell investigations, cross-field-beam analyzer investigations, hybrid crossed-field electron guns, and digital-computer studies of crossed-field guns. G.G.

N64-32675 Michigan U., Ann Arbor Inst. of Science and Technology
PROPERTIES OF COPPER PLASMA: CALCULATION OF THE PARTITION FUNCTION, SPECIES CONCENTRATION, AND SPECTRAL-LINE INTENSITIES
Stuart W. Bowen Jul. 1964 142 p refs
(Contract ARPA-SD-91; ARPA Order 236; Proj. Defender)
(Rept.-4613-66-T; AD-444386)

The self-consistent partition function; ionization potential lowering; electron, ion, and neutral-particle species concentrations; and the absolute spectral-line intensities of Cu I λ 5106 and Cu I λ 5153 are reviewed and tabulated for pressures between 0.03 and 10 atm, for original mole fractions between 10^{-4} and 0.03 and for temperatures from 2000° to 10 000° K, for copper vapor in a hot inert gas at thermal equilibrium. Only single ionization of copper is considered in this range of conditions. For the partition function cutoff, all electron states whose classical semimajor axis exceeds one-half the Debye distance are suppressed. Author

N64-32686 General Dyanamics Corp., San Diego, Calif John Jay Hopkins Lab. for Pure and Applied Science
MEASUREMENT OF PLASMA DENSITY IN A RAIL ACCELERATOR BY MEANS OF SCHLIEREN PHOTOGRAPHY
R. H. Lovberg 13 Nov. 1963 46 p refs Jointly sponsored by Gen. Atomic and Tex. Atomic Energy Res. Found. Submitted for Publication
(GA-4735)

A pulsed plasma accelerator having parallel plate electrodes has been operated in a mode that produces a flat sheet of current having one-dimensional variation of field and plasma parameters over most of its area. This current layer has been examined from the side with a fast double-traversal schlieren camera. Analysis of the photographs verifies a conclusion reached earlier through the use of magnetic and electric probe techniques, i.e., that the current sheet is nearly a perfect magnetic snowplow. Author

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-31374 General Electric Co., Cincinnati, Ohio Advanced Technology Services
HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report, 15 Jun.–15 Aug. 1964
30 Sep. 1964 41 p refs
(Contract AT(40-1)-2847)
(GEMP-39A) OTS: $2.00

In high-temperature reactor-materials fabrication research, work continued on the following: (1) stress-rupture and creep testing of Ta-10W, Re, W-25Re, and W-Re-Mo alloys at 1600° C; (2) development of W-Re-Mo alloys; and (3) a radioisotope containment capsule. In studies of the effect of radiation on high temperature metals and alloys, creep rupture tests were done on specimens subjected to various combinations of irradiation and annealing and of test temperatures and shielding. In research on high-temperature thermocouple and electrical materials, the effect of 3- and 6-month nuclear transmutations at 10^{14} thermal neutron flux on the thermoelectric output in the W/W-25Re thermocouple system was identified by synthesizing a series of alloys representing the transmutation products. The electrical resistance of Y_2O_3 was determined as a function of temperature up to approximately 2500° K. R.L.K.

N64-31375 Battelle Memorial Inst., Columbus, Ohio
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JULY, 1964
Russell W. Dayton and Ronald F. Dickerson 1 Aug. 1964 44 p ref
(Contract W-7405-ENG-92)
(BMI-1681 (Del.)) OTS: $1.00

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5. FUEL-IRRADIATION PROGRAM W. H. Goldthwaite, D. N. Sunderman, and J. E. Gates p L5–L12
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7. CORROSION STUDIES OF THE FLUORIDE-VOLATILITY PROCESS (ORNL) P. D. Miller, E. F. Stephan, and W. N. Stiegelmeyer p M1–M2
8. GAS-COOLED REACTOR PROGRAM (AGN) D. L. Keller p U1–U4
9. DEVELOPMENT OF SMALL RADIOISOTOPIC POWER SOURCES (SANDIA) J. F. Kircher p V1–V4 ref

N64-31466 Oak Ridge National Lab., Tenn. Research Materials Information Center
GROUPS IV, V, AND VI TRANSITION METALS. SELECTED REFERENCES ON PREPARATION, STRUCTURE, PHYSICAL PROPERTIES, METALLOGRAPHY, AND TRANSPORT PROPERTIES
Sep. 1964 27 p refs Sponsored by AEC
(ORNL-RMIC-3)

N64-31625 Westinghouse Electric Corp., Pittsburgh, Pa.
GROWTH AND CHARACTERIZATION OF SINGLE CRYSTALS OF RARE EARTH COMPOUNDS
[1964] 6 p ref
(Contract AF 49(638)-1245)
(QTR-1; AD-421023)

Three types of rare-earth compounds were prepared in powder form. They are the chalcogenides and halogens of divalent europium ions and the sulfides of trivalent rare-earth ions. Attention was focused, in connection with standard single-crystal growing, on the transport techniques because of the high melting temperatures and high reactivities of the europium monochalcogenides. Magnetization measurements were made on the dilute alloys of Gd containing (1 to 5) atomic % Ho or Nd to study the spin coupling of 4f electrons between neighboring rare-earth ions. A crystal was constructed for electrical measurements at low temperatures. A.W.

N64-31635 Aerospace Corp., El Segundo, Calif.
GROWTH DEFECTS IN FLUX-GROWN RUBIES
K. R. Janowski, E. J. Stofel, and A. B. Chase 28 Aug. 1964 22 p refs
(Contract AF 04(695)-469)
(TDR-469(9250-01)-1; SSD-TDR-64-166; AD-448467)

Ruby crystals of exceptional optical quality have been grown from fluxes composed of $Bi_2O_3 + PbF_2$ or $Bi_2O_3 + BiF_3$. Careful control of growth conditions was required to minimize the number of growth defects consisting primarily of dislocations, entrapped flux, and growth twins. Slow growth rates coupled with the addition of small amounts of La_2O_3 as a flux dopant were helpful in producing nearly perfect crystals. Chromium concentrations up to one percent were incorporated into these crystals without adversely affecting their perfection. Crystals up to 10 mm in diameter havihg as few as 1 to 10 dislocations per crystal were typical of those produced under optimum growth conditions. Under these same conditions, entrapped flux was eliminated, and growth twins were either eliminated or reduced to 1 to 3 twin boundaries per crystal. Author

N64-31642 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
II-VI LASER MATERIALS STUDY Final Technical Summary Report, 1 Jun. 1963–31 May 1964
G. Mandel, F. F. Morehead, and P. R. Wagner [1964] 121 p refs
(Contract Nonr-4216(00); Proj. Defender)
(AD-442258)

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1. SELF-COMPENSATION LIMITED CONDUCTIVITY IN BINARY SEMICONDUCTORS: EXPECTED CORRELATIONS WITH FUNDAMENTAL PARAMETERS p 19–49 refs (See N64-31643 23-25)
2. PREPARATION AND CHARACTERIZATION OF MATERIALS: CdTe p 51–54 (See N64-31644 23-25)
3. PREPARATION AND CHARACTERIZATION OF MATERIALS $Zn_xCd_{1-x}Te$ p 55–68
4. PREPARATION AND CHARACTERIZATION OF MATERIALS: NE COMPOUNDS p 69–72
5. PROPERTIES OF ELECTROLUMINESCENT DEVICES: CdTe HOMOJUNCTIONS p 73–88 refs (See N64-31645 23-25)
6. EFFICIENT, VISIBLE ELECTROLUMINESCENCE FROM P-N JUNCTIONS IN $Zn_xCd_{1-x}Te$ p 89–100 refs (See N64-31646 23-25)
7. INJECTION ELECTROLUMINESCENCE IN P-TYPE ZnTe p 101–111 refs (See N64-31647 23-25)
8. REPORTS, PUBLICATIONS AND ORAL PRESENTATIONS p 113–117

N64-31643 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
SELF-COMPENSATION LIMITED CONDUCTIVITY IN BINARY SEMICONDUCTORS: EXPECTED CORRELATIONS WITH FUNDAMENTAL PARAMETERS
In its II-VI Laser Mater. Study [1964] p 19–49 refs (See N64-31642 23-25)

A previously developed calculation of the degree of self-compensation in a binary semiconductor is used to obtain a useful correlation between the degree of self-compensation by singly ionized natural defects and the ratio of the electronic energy gap to certain generally known thermodynamic quantities. The latter quantities are related to the cohesive energy. It is shown, however, that the correlation factor given is more meaningful than the previously suggested ratio of the energy gap to the cohesive energy. The results are generalized to include compounds having a composition M_aN_b. One interesting conclusion is the prediction that M atom vacancies will generally dominate interstitial N atoms when $b < a$ and vice versa. Author

N64-31644 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
PREPARATION AND CHARACTERIZATION OF MATERIALS: CdTe
In its II-VI Laser Mater. Study [1964] p 51–54 (See N64-31642 23-25)

Low resistivity p-CdTe:P has been prepared from a melt containing excess Te and small amounts of P. The p-type conductivity as low as 0.5 ohm-cm was obtained, but the range of resistivities encountered was quite wide. A more effective process was the diffusion of P into melt-grown single crystals of CdTe under a Cd atmosphere at 850° C. This procedure yielded resistivities of 0.1 ohm-cm at the surface of a p-type layer that extended 30 microns into the bulk of the substrate crystal, after a two-week diffusion. The P and Cd were placed at the other end of the quartz capsule containing the CdTe crystal, which end was maintained at 800° C; the P and Cd were in an atomic ratio of 1:99. Hall effect measurements at 300° K and 77° K showed little freezeout of the hole concentration in these diffused samples; some freezeout was observed in the melt-grown samples of CdTe:P, but no evidence for an activation energy greater than 0.06 eV has been found Author

N64-31645 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
PROPERTIES OF ELECTROLUMINESCENT DEVICES: CdTe HOMOJUNCTIONS
In its II-VI Laser Mater. Study [1964] p. 73–88 refs (See N64-31642 23-25)

Graphs and figures are given for the CdTe diode capacitance measurements as a function of bias (at 77° K a graded junction

≈0.5μ wide, a carrier concentration gradient of 3×10^{20} cm^{-4}, and majority carrier concentrations on either side of the junction of about 10^{16} cm $^{-3}$; photovoltaic- and current-voltage data for CdTe diodes at 77° K and 300° K (which inidicate much lower external efficiencies); and electroluminescence of CdTe diodes at constant current as a function of temperature that fits the standard photoluminescence-efficiency temperature relation: $B = Bo/1 + a \exp(-E/kT)$. A.W.

N64-31646 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
EFFICIENT, VISIBLE ELECTROLUMINESCENCE FROM P-N JUNCTIONS IN $Zn_xCd_{1-x}Te$
In its II-VI Laser Mater. Study [1964] p 89–100 refs (See N64-31642 23-25)

Values for $Zn_xCd_{1-x}Te$ diodes were determined either from the value of the crystal parameter from X-ray data or from the value of the band edge and the variation of band gap with composition. Band-gap data are obtained from the wavelength dependence of the short circuit photovoltaic current. A 100-times decrease in temperature dependence of the electroluminescence is observed in going from 77° to 300° K. In summary, including Zn along with Cd in the reservoir for P diffusion into n-type CdTe, Al changes the composition of the diode material to $Zn_xCd_{1-x}Te$, shifting the electroluminescence into the visible and solving the problem of high contact resistances as well. A.W.

N64-31647 International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center
INJECTION ELECTROLUMINESCENCE IN P-TYPE ZnTe
In its II-VI Laser Mater. Study [1964] p 101–111 refs (See N64-31642 23-25)

External quantum efficiences at 77° K of the order of a few percent, at high current densities, have been attained by minority carrier injection from blocking contacts into p-type ZnTe. The injection EL was observed at temperatures between room temperature and 77° K and was accomplished in two manners: by injection through an insulating film or through what is believed to be an inversion layer contact made directly to the cleaved surface of the crystal. Pulsed current densities of greater than 10^4 amp/cm^2 were applied to the diodes without observing either line narrowing or a precipitous increase in efficiency characteristic of stimulated emission. The two types of contacts used to achieve minority carrier injection gave comparable quantum efficiencies and spectral characteristics. Author

N64-31648 Frankford Arsenal, Philadelphia, Pa. Research and Development Directorate
PLASMA-INTERBAND COUPLING IN β' CuZn
Keith H. Johnson (Temple U.) and Robert J. Esposito Apr. 1964 7 p refs Repr. from J. Opt. Soc. Am., v. 54, no. 4, Apr. 1964 p 474–477 Partially sponsored by AEC
(A64-12; AD-446660)

Normal-incidence reflectivity data for β' CuZn has been subjected to a Kramers–Kronig analysis for its optical constants in the spectral region $2\text{ eV} \leq \hbar w \leq 3\text{ eV}$ (4140 Å $\leq \lambda \leq$ 6200 Å) in order to explain the nature of an observed reflectivity edge at 5000 Å. Extrapolations of the data into the infrared and ultraviolet were made. The frequency dependence of the optical constants indicates a plasma resonance at 2.52 eV (4920 Å), shifted and damped from its classically predicted value by the influence of interband transitions occurring at approximately the same energy. The spectral behavior of the optical constants in this region is not very sensitive to the exact nature of the extrapolation. Author

N64-31674 Naval Ordnance Lab., White Oak, Md.
ON A MECHANISM FOR THE SHOCK POLARIZATION OF DIELECTRICS
Paul Harris Sep. 1964 13 p refs
(NOLTR-64-121; AD-448080)

A simplified account is given of a mechanism that explains the shock polarization of nonpiezoelectric dielectrics. The mechanism invokes a shock-induced breakdown of the symmetry that is characteristic of nonpiezoelectrics. The conclusion reached is that a polarization is developed that is proportional to the gradient of the stress. Consequently the entire voltage drop is predicted to lie across the shock front under open circuit conditions. In the alkali halides a 10-V signal is predicted for a stress of 100 kb. Author

N64-31685 Stanford U., Calif. Microwave Lab.
THE EFFECT OF HOLE MOBILITY ON ACOUSTIC WAVE AMPLIFIERS
Kjell Blotekjaer Aug. 1963 26 p refs
(Contract Nonr-225(48))
(ML-1072; AD-421189)

Acoustic waves can be amplified by interaction with drifting electrons in piezoelectric semiconductors. Amplifiers built on this principle tend to be unstable, because waves reflected from inhomogeneities or a mismatched output propagate in the backward direction with very little attenuation. It is shown that the backward attenuation can be increased substantially by allowing the reflected waves to interact with drifting holes. The propagation characteristics of the waves on the drifting electrons and holes are discussed, and numerical calculations are carried out to show that the presence of the holes tends to stabilize the amplifier. The proposed scheme requires a piezoelectric semiconductor with high intrinsic conductivity. Author

N64-31690 Stanford U., Calif.
APPARATUS FOR THE DETERMINATION OF DYNAMIC YOUNG'S MODULUS AND INTERNAL FRICTION AT TEMPERATURES FROM 25°C TO 1200°C
J. L. Lytton, J. A. Hren, K. T. Kamber, and O. D. Sherby 15 Sep. 1963 28 p refs Sponsored by AF
(DMS-63-17; AD-421952)

The determination of dynamic Young's modulus and internal friction, utilizing transverse free-free vibration in vacuum at temperatures from 25° to 1200° C, is described. High temperatures are achieved with a highly efficient elliptical radiation furnace, whose design and construction are described in detail. The two wires used for driving and sensing are also the two legs of a thermocouple circuit, which are attached to opposite ends of metallic specimens; the specimen itself completes the thermocouple circuit. The electronic components that allow determination of both decay time and resonant frequency, using a frequency counter, are presented along with a description of the method of operation. The accuracy of the measurements is discussed, and typical experimental results for an Fe-Si and Fe-Co alloy, as well as for nickel, are presented. Author

N64-31739 University Coll., Cardiff (Gt. Brit.)
AUGER RECOMBINATION INTO TRAPS Scientific Report No. 3
P. T. Landsberg, C. Rhys-Roberts, and P. Lal 1 Jul. 1964 10 p
(Contract AF 61(052)-664)
(AFCRL-64-747; AD-606682)

Earlier theoretical work on the recombination coefficients (T's) in the main Auger recombination processes with participating traps is extended by considering Auger transitions into excited hydrogen-like states, by more accurate integrations over states, and by treatment of exchange effects and of T_2 and T_4. Graphs of $T_i / |F_i|^2$ for various values of principal quantum number n and angular momentum quantum number l are given. The results suggest that at low temperatures T_1 is very small if $n + l$ is even. M.P.G.

N64-31801 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TESTING OF FERROMAGNETIC MATERIALS (MAGNETIC MEASUREMENTS)
I. I. Kifer 19 Jun. 1964 596 p refs Transl. into ENGLISH of "Ispytaniya Ferromagnitnykh Materialov (Magnitnyye Izmereniya) Moscow, Gosenergoizdat., 1962 p 3-544
(FTD-TT-63-531/1+2; AD-605232)

CONTENTS:

1. THE CHARACTERISTICS DETERMINING THE BEHAVIOR OF FERROMAGNETIC MATERIALS IN A MAGNETIC FIELD p 4-87 refs
2. FERROMAGNETIC MATERIALS p 88-125 refs
3. BALLISTIC AND MAGNETOMETRIC METHODS p 126-186 refs
4. METHODS OF PRODUCING AND MEASURING MAGNETIC FIELDS p 187-241 refs
5. TESTING SOFT-MAGNETIC MATERIALS IN CONSTANT MAGNETIC FIELDS p 242-286 refs
6. INVESTIGATION OF MAGNETICALLY SOFT MATERIALS IN ALTERNATING MAGNETIC FIELDS p 287-453 refs
7. DETERMINING THE CHARACTERISTICS OF MAGNETICALLY HARD MATERIALS p 454-523 refs
8. THE ELEMENTS OF ELECTROMAGNETIC FLAW DETECTION p 524-561 refs

N64-31811 Centro di Studio per la Fisica delle Microonde, Florence (Italy)
MANY ELEMENT LASERS Scientific Report No. 1
R. Pratesi, L. Ronchi, and G. Toraldo di Francia Apr. 1964 24 p refs
(Contract AF 61(052)-720)
(AFCRL-64-604; AD-603968)

Theoretical and experimental results are reported, obtained with a solid-state laser consisting of many active elements in series. A statistical treatment is developed to derive the oscillation conditions. Asymptotic expressions are given of the threshold gain per unit length holding either for a very large number of elements or for inner surface reflectivities close to 1. Lossless reflections at the inner surfaces can increase the cavity Q with respect to a one-element laser of the same active length. Preliminary experiments with five- and ten-element lasers demonstrate the mode selection property of the many-element laser and show the tendency of the system to a "quasi-continuous" emission. The possibility of obtaining some optical correction of the defects inherent in the solid material has also been demonstrated. Author

N64-31814 Weizmann Inst. of Science, Rehovoth (Israel)
ANGULAR VARIATION OF COERCIVITY IN ORTHOFERRITE SINGLE CRYSTALS
S. Reich, (M.S. Thesis) S. Shtrikman, and D. Treves 1 Aug. 1964 19 p refs
(Contract AF 61(052)-654)
(TN-6; AD-605719)

The coercive force Hc as a function of the angle Θ between the easy axis of magnetization and the external field has been studied in orthoferrite single crystals using the vibrating sample technique. The experimental results are in good agreement with the Kondorsky 180° wall motion model as they obey the predicted relation:

$$\cos \Theta = \frac{Hc(0)}{Hc(\Theta)}$$

Author

N64-31819 General Electric Co., Schenectady, N.Y. Research Lab.
SEMICONDUCTOR DEVICE CONCEPTS Scientific Report No. 8
H. H. Woodbury, M. Aven, P. R. Kennicott, and R. N. Hall Aug. 1964 51 p refs
(Contract AF 19(628)-329)
(AFCRL-64-702; AD-606311)

Studies on the systems CdS:Cu and CdS:Ag have led to the following results: (1) Copper and Ag diffuse very rapidly in CdS, even below 500° C. (2) The segregation coefficient of Ag for CdS:Cd changes from 5×10^{-7} to 10^{-3} between 500° and 1000° C. (3) the solubility of Ag in CdS depends strongly on the partial pressure of Cd over the crystal. These results are interpreted in terms of interstitial Ag and an undefined complex involving substitutional Ag. The effect of impurities on the electrical characteristics of ZnSe single crystals has been investigated by Hall-effect studies coupled with mass spectrometric measurements. Considerable differences in the impurity spectrum as well as in the electrical behavior of the crystals were found to exist, depending on the starting materials, the crystal growth method, and the purification techniques used. A junction laser structure capable of frequency modulation is discussed. Frequency deviations of the order of 100 Gc at modulation frequencies of several Gc appear reasonable. Author

N64-31821 Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
RESONANCE MODES AT DEFECTS IN CRYSTALLINE QUARTZ Scientific Report No. 1
D. W. Feldman and J. G. Castle, Jr. 17 Jun. 1964 13 p refs
(Contract AF 19(628)-3838)
(AFCRL-64-597; AD-606051)

The Raman spin-lattice relaxation time, T_{1R}, for the oxygen divacancy (E_1') center in synthetic crystalline quartz measured in applied magnetic fields of 3 kOe is accurately given by

$$\frac{1}{T_{1R}} = B \frac{e^{x_1}}{(e^{x_1} - 1)^2} + C \frac{e^{x_2}}{(e^{x_2} - 1)^2} + D e^{-x_3},$$

where the coefficients are

$$B = 0.25 \text{ sec}^{-1},$$
$$C = 250 \text{ sec}^{-1},$$
$$D = 300\,000 \text{ sec}^{-1},$$

and the characteristic frequencies have the corresponding temperatures of $x_1 T = 20 \pm 2°$ K, $x_2 T = 125 \pm 10°$ K, and $x_3 T = 1400 \pm 300°$ K. The two lower frequencies are interpreted in terms of mechanical resonances being localized at each center and having large resonant amplitudes. The highest frequency is tentatively associated with some of the optical modes of the SiO_2 lattice. There is no evidence for relaxation by the acoustic modes having the normal Debye cutoff. Author

N64-31905 General Electric Co., Lynn, Mass. Direct Energy Conversion Operation

SEMICONDUCTING COMPOUNDS WITH APPLICATIONS TO THERMOELECTRICITY Final Report, Mar. 1963–Mar. 1964

J. H. Bredt, L. F. Kendall, and R. H. Vought Ft. Eustis, Va., Army Transportation Res. Command, Jul. 1964 60 p refs
(Contract DA-44-177-AMC-2(T))
(TRECOM-TR-64-35; AD-604029)

Reliable procedures were established for preparing samples of the system $Mg_2Ge_xSn_{1-x}$, with x ranging from 0 to 1, and the peritectic nature of the system was demonstrated. Samples were evaluated by measuring the Seebeck coefficient, electrical resistivity, thermal conductivity, and Hall constant. Parameters of interest to thermoelectric applications were calculated from these experimental quantities. A brief discussion is presented of the possibilities of reducing thermal conductivity through magnetic scattering of phonons by phonon-assisted transitions between low-lying levels of electrons in the incomplete 3d or 4f shells of transition metal impurities introduced into the lattice. In an attempt to dope Mg_2Sn and $Mg_2Ge_{0.5}Sn_{0.5}$ with Fe atoms, relatively little iron went into solution, and no decrease in thermal conductivity was noted. One sample of Mg_2Sn was reprocessed by hot pressing and yielded a sample with 92% of theoretical density that exhibited nearly the same thermoelectric properties as the crystal before grinding. Author

N64-31909 Precision Instrument Co., Palo Alto, Calif.

COHERENT LIGHT-RECORDING TECHNIQUES

Carl H. Becker, Art Haines, and Siegfried Mohr Griffiss AFB, N.Y., RADC, Jul. 1964 54 p refs
(Contract AF 30(602)-3272)
(RADC-TDR-64-203)

The study extends toward theoretical evaluation of the minimum obtainable bit size on photographic film, and the experimental verification of the theoretical prediction. Theoretical results obtained are as follows: (1) The minimum bit size (D) obtainable with coherent light-recording techniques equals $D = 1.22\lambda(f/o)$, where λ is the laser wavelength, o is the laser aperture (assumed to be equal to the camera aperture), and f is the focal length of the focusing camera lens. (2) The maximum number (N) of bits per sweep equals $N = \gamma o/1.22\lambda$, where γ is the deflection angle of the coherent light beam. Experimental results essentially verified the theoretical analysis. Author

N64-31916 Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.

500° C SILICON CARBIDE RECTIFIER PROGRAM Interim Technical Progress Report No. 8, 1 Jul.–30 Sep. 1963

H. C. Chang, V. J. Jennings, D. R. Thornburg, L. J. Kroko, J. Ostroski et al Wright-Patterson AFB, Ohio, ASD [1963] 24 p ref
(Contract AF 33(657)-7027)
(ASD-IR-7-727(VIII); AD-420375)

The growth rate of silicon carbide crystals prepared by the sublimation method has been determined by measuring the amount of growth between successive, timed dopant additions. This has been compared with the growth rate as obtained from a simple model. All values agree within a factor of five. The use of molten borax as an etchant for silicon carbide has been studied. Due to its relatively slow etch rate (about 30 times slower than a molten sodium peroxide–sodium hydroxide mixture) a much finer control of the etching is possible. Details are given on the life and storage tests that were successfully passed by two silicon carbide rectifiers. An open-tube flowing gas system has been shown suitable for the surface passivation of groups of silicon carbide rectifiers. Author

N64-31932 Catholic U. of America, Washington, D.C.

MIXED BISMUTH OXIDE (MBO) TYPE FERRIELECTRICS

Charles F. Pulvari Wright-Patterson AFB, Ohio, AF Avionics Lab., May 1964 76 p refs
(Contract AF 33(657)-10454)
(AL-TDR-64-124; AD-605663)

The simplest mixed bismuth oxide with a layer-type structure, having the formula $Bi_4Ti_3O_{12}$, was found to be a degenerate antiferroelectric material exhibiting a pronounced and stable threshold switching field. This new material exhibits a stable ferrielectric state from nearly 0° K up to several hundred degrees centigrade, and represents, at present, a material with the widest region of stable ferroelectric behavior. The preparation of these complex crystals, as well as their morphology, is discussed. The result of electrical and optical measurements are presented, and the domain structure of the crystals has been determined. Some of the semiconductive properties were studied, and the effect of impurities on the threshold and bias fields is presented. Author

N64-31940 Research Triangle Inst., Durham, N.C. Solid State Lab.

INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME V: PHYSICAL/ELECTRICAL PROPERTIES OF SILICON Technical Documentary Report, May 1963–Jan. 1964

R. A. Evans Wright-Patterson AFB, Ohio, AF Avionics Lab., Jul. 1964 212 p refs
(Contract AF 33(657)-10340)
(ASD-TDR-63-316, Vol. V; AD-605558)

The various properties of silicon to which numbers can be assigned are discussed. These numbers, as found in the literature, are listed for each effect or property. Some applications of these properties and the theory behind them are given. The properties are grouped under four general headings: mechanical and lattice properties, piezo-properties, electric–thermal–magnetic properties, and photo-properties. Author

N64-31980 Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

RADICAL-MATRIX INTERACTIONS IN LOW TEMPERATURE GLASSES: PHOTO-REVERSIBILITY

S. Siegel and H. S. Judeikis 1 Sep. 1964 39 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-110; TDR-269(4240-30)-8; AD-606057)

The near UV irradiation of ether and/or ethanol glasses at low temperatures (100° ±25° K) leads to the formation of trapped ethyl radicals via an excited impurity-solvent interaction. The radicals were observed by electron paramagnetic resonance spectroscopy, both during the irradiation and during the post-irradiation period. The EPR spectral line shapes of the ethyl radicals changed as a function of time after light extinction and also of temperature during irradiation. Qualitative kinetics of the spectral changes were examined in some detail. In the absence of dissolved oxygen the spectral line shape changes are reversible upon re-irradiation; in the presence of oxygen the ethyl radical is irreversibly converted into the RO_2 radical at temperatures where the oxygen can appreciably diffuse. The origins of the spectral changes are discussed in terms of hindered rotational motions and localized phase changes. Author

N64-31985 National Co., Inc., Malden, Mass.

STUDIES IN EXCHANGE INTERACTIONS TO PRODUCE POPULATION INVERSIONS IN LASER MATERIALS Final Report

George W. Myers, Raoul M. Freyre, William T. Kwo, and Eugene C. La Vier 20 Mar. 1964 49 p refs
(Contract AF 19(628)-2481)
(AFCRL-64-261; AD-605730)

The pure chlorides of praseodymium and erbium, and mixtures, were investigated with regard to those properties significant in laser application. Cooperative ion absorptions were examined in $PrCl_3$ and the cross section was determined for the $^3P_0 + {}^3F_2$ level. Lifetime of the $^3P_0$ state in $PrCl_3$ was determined. The $ErCl_3$ as well as Er^{3+} in a $PrCl_3$ lattice was examined for coupled interactions. Author

N64-31986 Franklin Inst., Philadelphia, Pa.
THE MAGNETIC PROPERTIES OF FCC SINGLE CRYSTAL COBALT FILMS Scientific Report No. 4
William D. Doyle (Ph.D. Thesis, Temple U.) Apr. 1964 131 p refs
(Contract AF 19(628)-2415)
(AFCRL-64-420; AD-603720)

A study of the anisotropy and the magnetization reversal process in face-centered-cubic (fcc) single-crystal cobalt films is presented. The films were prepared as single crystals by evaporation onto the (100) face of heated MgO substrates. Studies carried out on the anisotropy and the magnetization reversal process in the (100) film plane indicated that the anisotropy at room temperature in the as-deposited films varies from -3×10^5 to -7×10^5 ergs/cc. Annealing at high temperatures raised this to -17×10^5 ergs/cc. These results were interpreted in terms of the stress anisotropy model of Freedman, and it was found that the anisotropy in the as-deposited film is lowered by a magnetoelastic contribution. The analysis also indicated the magnetostrictive constants are very large and of the order of 10^{-3} to 10^{-4}. Two models of magnetization reversal, coherent rotation and noncoherent rotation, were extended to the case of biaxial anisotropy. Comparison with experimental results indicated that neither model adequately described the results over the entire field. At low fields, the noncoherent, or Kondorsky, model was a much better description than the coherent or Stoner–Wohlforth model, while at high fields the reverse was true. P.V.E.

N64-32000 Kansas U., Lawrence
EXPERIMENTAL STUDY OF THE MAGNETIC FIELD DEPENDENCE OF SPIN-LATTICE RELAXATION BY THE ORBACH PROCESS IN NEODYMIUM MAGNESIUM NITRATE
J. T. Hoffman and R. C. Sapp 25 Aug. 1964 30 p refs
(Contract Nonr-2775(00))
(TR-6; AD-605334)

The spin-lattice relaxation time of trivalent Nd ions in Nd-Mg nitrate was measured by fitting Casimir-du Pré dispersion curves to the frequency dependence of the self-inductance of a coil into which the sample could be inserted. The difference in self-inductance, with and without the sample, was determined by a modified Owen bridge at liquid helium temperatures and in fields between zero and 1800 Oe. In the 3.3° to 4.2° K range the Orbach process dominates and is identified by its characteristic exponential inverse temperature variation. For H perpendicular to the crystal axis, good agreement was found with Orbach's theory for the magnetic field dependence of this process. Author

N64-32002 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
SOME ASPECTS OF THE PHOTOCONDUCTIVITY IN THE MICROCRYSTALLINE POWDERS OF CdS [ALCUNI ASPETTI DELLA FOTOCONDUZIONE NELLE POLVERI MICROCRISTALLINE DI CdS]
L. Bartolini 24 Jun. 1964 13 p refs In ITALIAN *Its* Nota Interna No. 248
(LNF-64/30)

A method for studying the photoconductivity of microcrystalline powder cadmium sulfide is described. For low levels of irradiation (10^{-9} amp), using a neon lamp source, both rise and decay times are large; for high levels (10^{-7} amp), they are small. The ratio of rise and decay times is about 10 for high levels of irradiation, and about unity for low levels.
Trans. by P.F.E.

N64-32004 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
EXPERIMENTAL STUDY OF THE DECAY OF PERSISTENT CURRENTS IN SOFT SUPERCONDUCTING RINGS UNDER α-PARTICLE IRRADIATION
N. Sacchetti, G. Sacerdoti, G. Sanna, F. Suriglio, and A. Susanna 22 Jul. 1964 17 p refs Submitted for Publication *Its* Nota Interna No. 251
(LNF-64/35)

In a previous experiment, it was observed that the persistent current in a thin P_b superconducting ring decays when the material is subjected to α-particle irradiation from a Po^{210} source. Systematic observations of flux decay have been carried out under different experimental conditions. The effects of varying the temperature (from 1.1° to 4.2° K), the thickness of superconducting layers (from about 10μ to 40μ), and the materials (lead, tin, and indium) have been investigated. The flux decay law deduced from the experimental data seems to be logarithmic in time, showing a behavior similar to that observed by Kim et al. for flux creep in hard superconductors. Author

N64-32061 Minneapolis-Honeywell Regulator Co., Hopkins, Minn. Honeywell Research Center
DISLOCATION CONFIGURATIONS AND THE INITIATION OF YIELDING IN MAGNESIUM OXIDE
R. J. Stokes and C. H. Li Jun. 1964 39 p refs
(Contract Nonr-4076(00))
(TR-24; AD-601863) OTS: $2.00

This paper distinguishes between the role of fresh, aged, grown-in, and high-temperature dislocations in the initiation of plastic flow in magnesium oxide single crystals. Grown-in dislocations in commercial purity crystals cannot be moved even under very high stresses, and play no role in initiating slip at room temperature. Plastic deformation originates from fresh dislocation loops injected into the crystal surface. Fresh dislocations, introduced by prestrain at room temperature, become aged at high temperatures resulting in dislocation locking and an increase in stress to reinitiate slip. Weak locking occurs above 600° C and strong locking above 1200° C. Dislocations are almost completely immobilized by heating to 1900° C. Changes in dislocation configuration upon heating were studied by etch pit and electron transmission techniques. Author

N64-32088 Lincoln Lab., Mass. Inst. of Tech., Lexington
ANTIFERROMAGNETIC RESONANCE LINEWIDTH IN HnF_2 NEAR THE TRANSITION TEMPERATURE
J. C. Burgiel 18 Jun. 1963 44 p refs
(Contract AF 19(628)-500)
(TR-302; AD-420809)

The antiferromagnetic resonance (AFMR) linewidth of MnF_2 has been studied near the Néel temperature. In the presence of an applied magnetic field, the linewidth diverges as $|T-T_N|^{-5/6}$. In the absence of an applied field, the linewidth is larger and diverges approximately as $|T-T_N|^{-4/3}$. The linewidth is independent of magnetic field direction and is the same for

both branches of the AFMR spectrum. Near T_N the AFMR frequency varies as $|T - T_N|^{0.483 \pm 0.025}$ compared to $|T - T_N|^{1/2}$ for the Brillouin function. From this temperature dependence, together with existing data on the fluorine nuclear magnetic resonance in MnF_2, the anisotropy energy E_A is found to be proportional to $M^{2.89 \pm 0.16}$ compared to Zener's M^3 and Oguchi's $M^{2.9}$ low-temperature theoretical results. Above T_N the electron paramagnetic resonance in MnF_2 has been observed. For $H \parallel c$ the linewidth varies as $(T - T_N)^{-3/8}$ near T_N. For $H \perp c$ the linewidth increases more slowly as T_N is approached. Author

N64-32104 Mithras, Inc., Cambridge, Mass.
MEASUREMENT OF THE SPIN-FLOPPING RELAXATION TIME IN Cu $Cl_2 \cdot 2H_2O$ Scientific Report No. 4
Charles S. Naiman and Thomas R. Lawrence May 1964 56 p refs
(Contract AF 19(628)-2395)
(MC-62-49-R4; AFCRL-64-580; AD-606885)

As part of a study of the dynamic properties of magnetic phase transitions, the relaxation time associated with the spin-flopping transition in $CuCl_2 \cdot 2H_2O$ was measured. A relaxation time, t_{sf}, of $(0.70 \pm 0.15) \times 10^{-7}$ seconds at 2.4° K was found. Measurements also yield the temperature dependence of the critical field, H_c, which is in agreement with previous data. The $CuCl_2 \cdot 2H_2O$ crystal was placed in a coil and in the gap of an electromagnet, so that the a-axis of the crystal, the axis of the coil, and the constant magnetic field, H, were all parallel. The radio-frequency inductance and resistance of the coil were measured twice—first with $H \neq H_c$, then with $H = H_c$. The inductive and resistive components of the critical field susceptibility, χ_c, and $\chi_{c''}$ are obtained from the observed shifts in inductance and resistance. Author

N64-32106 Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
SILICON Data Sheets
M. Neuberger May 1964 214 p refs
(Contract AF 33(615)-1235)
(DS-137; AD-601788)

These data sheets present a compilation of a wide range of electrical, optical, and energy values for pure and variously doped silicon in bulk and film form. Electrical properties include conductivity, resistivity, dielectric constant, Hall coefficient, mobility, lifetime, thermoelectric, and thermomagnetic. Emission data have been broken down in the varied electron and photon emissions that result from application of energy in the electromagnetic spectrum. Energy data include energy bands, energy gap, and energy levels for variously doped silicon, as well as effective mass tables, work function, carrier diffusion, and cross sections. The optical properties include absorption, reflection, and refractive index. Other magnetic data and irradiation effects are included, as well as several bordering physical phenomena such as piezoelectric properties, Debye temperature, and thermal conductivity. Author

N64-32113 Air Force Cambridge Research Labs., Bedford, Mass.
BIBLIOGRAPHY OF ROCK DEFORMATION Special Reports No. 5
R. E. Riecker Sep. 1964 56 p refs
(AFCRL-64-713; AD-606550)

A bibliography of 490 rock-deformation research articles published in scientific journals is presented with both subject and author entries. The cross-referenced subject listings fall into the following major categories: apparatus, brittle behavior, calcite, calibration, compressibility, conductivity, creep, density, dolomite, elastic behavior and elastic constants, fabric, friction, general, marble, metals, olivine, phase studies, plastic behavior, quartz, resistance, safety, sedimentary rocks, seismic velocities, shear, shock, strain rate, surveys, viscosity, X-ray. Author

N64-32132 Emmanuel Coll., Boston, Mass. Research Language Center
THE INFLUENCE OF TEMPERATURE AND MAGNETIZATION IN SELECTIVE ABSORPTION AND FLUORESCENCE SPECTRA [DER EINFLUSS VON TEMPERATUR UND MAGNETISIERUNG BEI SELEKTIVEN ABSORPTIONS—UND FLUORESZENZSPEKTREN]
H. du Bois and G. J. Elias Bedford, Mass., AFCRL [1963] 70 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 35, no. 4, 1911 p 617–678
(Contract AF 19(604)-8505)
(E-T-G-63-7; AD-420440)

A high-dispersion spectroscope and a direct-vision high-intensity monochromator were used to investigate the influence of temperature and magnetization in selective absorption and fluorescence spectra of ruby. The rotational polarization was also quantitatively investigated, and it was found that each absorption band has a corresponding anomaly of rotation that often is quite considerable. For lower temperatures, the increase of this effect is many times inversely proportional to the absolute temperature. Within and in the vicinity of the bands, the rotation no longer appears to remain proportional to the field. The normal dispersion curve for neodymium nitrate was also determined, and a weak transversal magnetic birefringence was found for a concentrated erbium nitrate solution. The birefringence extended over the entire spectrum without particularly significant deviations in the bands. These results are difficult to explain in terms of any theory, and they indicate the need for new points of view, particularly in the theory of fluorescence. M.P.G.

N64-32134 Sheffield U. (Gt. Brit.)
IMPURITIES AND IMPERFECTIONS IN METALS AND SEMICONDUCTORS Final Technical Report, Aug. 1, 1962–Jul. 31, 1963
A. D. Boardman and N. H. March [1963] 55 p refs
(Contract DA-91-591-EUC-2644)
(FTR-5; AD-420875)

Numerical calculations for Cu- and Al-based alloys, founded on the free-electron theory of specific heat of dilute alloys, are presented. It is indicated that the second-order results do not differ greatly from first-order results provided the self-consistent second-order potential is used. Investigations of the effect of the Fourier components of the periodic lattice potential on the specific heat of a dilute noble metal-based alloy were conducted to establish the change in the density of states when the Fermi surface is in contact with the zone boundary. Two models are derived from which the electron density can be obtained as a function of the Fermi energy. The use of the perturbation theory of March and Murray to obtain an approximate relation between the density itself and its energy derivatives is demonstrated. The shift of the Fermi level with concentration in less dilute alloys is considered, as is the Wannier-function approach to the impurity problem and its relationship to the density-matrix approach. M.P.G.

N64-32186 Research Triangle Inst., Durham, N.C.
INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME IV: DIFFUSION Technical Documentary Report, Feb. 1963–Jan. 1964
Feb. 1964 230 p refs
(Contract AF 33(657)-10340)
(ASD-TDR-63-316, Vol. IV; AD-603716)

Both the theoretical and the practical aspects of impurity diffusion in silicon are discussed. Fick's second law is solved for a number of boundary conditions; the solutions obtained are compared with the measured data and shown to be valid only under certain experimental conditions. The experimentally determined values of the diffusion coefficients of 28 impurities in silicon are listed. Concentration, both of background impurity and diffusion impurity, can influence the value of the diffusion coefficient. This influence is illustrated by data from boron and phosphorous diffusions. Some typical, practical diffusion systems are described, emphasizing the techniques of open-tube diffusion of boron and phosphorus. Author

N64-32198 Weizmann Inst. of Science, Rehovoth (Israel)
SPONTANEOUS MAGNETIZATION IN ORTHOFERRITES BETWEEN LIQUID AIR TEMPERATURE AND THE CURIE POINT
G. Gorodetsky and D. Treves 10 Aug. 1964 13 p refs
(Contract AF 61(052)-654)
(TN-8; AD-605721)

Results of measurements of the ferromagnetic moment of rare-earth orthoferrites between 90° K and the Curie point are presented. These results show that the rare-earth ions behave like a paramagnet in an effective field due to the iron ions. Author

N64-32202 Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
PYROCERAM Data Sheets
John T. Milek Aug. 1963 43 p refs
(Contract AF 33(615)-1235)
(DS-130; AD-421883)

Pyroceram is essentially a crystalline material formed from a noncrystalline glass. A glass batch containing one or more nucleating agents is melted, formed, and cooled. Subsequent heat treatments cause the nucleating agents to form billions of submicroscopic crystallites per cubic millimeter in the pyroceram. The end product, after heat treatment, is a fine-grained crystalline material, nonporous, and reportedly harder than most ceramics and many metals. Pyroceram can be formed by conventional glass-forming methods: blowing, drawing, pressing, rolling, and casting. Author

N64-32212 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
A STUDY OF LATTICE VIBRATIONS THROUGH THE TEMPERATURE DEPENDENCES OF X-RAY BRAGG INTENSITIES Technical Report, 1 Jun. 1958–31 May 1963
R. M. Nicklow and R. A. Young 20 Jul. 1964 275 p refs
(Contract Nonr-991(00))
(TR-3; AD-605501)

From the temperature slope of essentially continuous Bragg intensity versus temperature data, it is possible to obtain meaningful values for the temperature derivatives, dB/dT, of the Debye–Waller factors for both a monatomic (copper type) structure and for each type of atom in an NaCl-type structure. This technique has been applied to the study of thermal vibrations in Al, KCl, and AgCl in the 100° to 300° K range. The intensity-vs-temperature results have been related in a straightforward way to the elastic frequency spectrum, and detailed comparisons made with predictions based on actual spectra. A study was made of the thermal diffuse scattering (TDS) contributions to the Bragg intensities measured; results indicated the contributions were determined to within 5% to 15%. D.S.G.

N64-32231 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 113
6 Oct. 1964 23 p Transl. into ENGLISH from Chinese Periodicals
(JPRS-26744; TT-64-51001) OTS: $1.00

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N64-32232 Joint Publications Research Service, Washington, D.C.
ABOUT LASERS AND ITS APPLICATIONS
Nan-an *In its* Transl. on Communist China's Sci. and Technol. No. 113 6 Oct. 1964 p 1–8 Transl. into ENGLISH from Jen-min Jih-pao (Peiping), 7 Sep. 1964 p 5 (See N64-32231 23-25) OTS: $1.00

For all practical purposes, lasers are an energy conversion unit. The different types of input energy are electromagnetic energy (using radio or light frequencies) or electrical current; the output energy is a stimulated emission of light that has special characteristics—good monochromatic quality (uniform frequency), good directional property (the light bundles are highly parallel), good coherence (the light waves are synchronous), and extreme intensity not shared by other light beams. Four types of lasers already produced are solid state, gaseous, semiconductor, and liquid. The principal applications of lasers are light communication; light radar and light distance measurement; possibilities for use as antimissile weapons; optical welding, cutting, and hole-punching; and optical surgery. A.W.

N64-32238 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CURRENT PROBLEMS IN CRYSTALLOGRAPHY
B. K. Vaynshteyn 4 Aug. 1964 18 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), no. 6, 1963 p 31-38
(FTD-TT-64-589/1; AD-605468)

This paper contains a generalized report on crystallography, pertaining to atomic and real structures of crystals, investigation of their properties, and the mechanism of crystal formation and their applications, with emphasis on the variability of crystal properties by manipulated conditions. G.G.

N64-32252 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
POWER DEPENDENT FREQUENCY SHIFTS IN RUBY LASERS AT 77°K
M. Birnbaum and T. L. Stocker 15 Jun. 1964 28 p refs
(ATN-64(9216)-3)

Ruby lasers, when operated near threshold at 77° K with a low Q cavity (one end silvered for maximum reflectivity and the other end uncoated) oscillated at two frequencies. The freferent lengths were determined by means of Fabry–Perot etalons. The measured frequency differences near threshold were in good agreement with prior determinations of the splitting of the R_1 doublet by microwave methods. As the power level of the laser was increased, the frequency differences between the oscillating components [$2E\text{-}^4A_2(\pm 3/2, \pm 1/2)$] were found to decrease. These results are accounted for on the basis of saturation broadening of overlapping Lorentzian lines. The observed variations in the splitting are in good accord with the theory. Author

N64-32269 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
UNIAXIAL DIELECTRIC RODS IN CYLINDRICAL CAVITIES
Ross F. Lohr, Jr. Apr. 1964 50 p refs
(Grant AF-AFOSR-453-63)
(PIBMRI-1219-64; AD-601693)

In frequency regions well above the lowest resonant frequencies of a circularly cylindrical cavity, the mode density, i.e., the number of modes within a given, relatively small frequency interval, is generally quite high, and the identification of experimentally found resonances with specific cavity modes cannot usually be accomplished by frequency considerations alone. Two techniques useful in such identifications are presented here. One of these can be employed to gain information concerning the angular periodicity of the mode, and the other gives an indication of its axial periodicity. A new method of measuring the dielectric constants (tensor) of a uniaxial material, which is based on the exact solution of a large dielectric rod located in a circularly cylindrical cavity, is also presented. The characteristic equations required in this connection have been derived and are given. Author

N64-32270 Pennsylvania U., Philadelphia Towne School of Civil and Mechanical Engineering
VISCOELASTIC BEHAVIOR OF HETEROGENEOUS MEDIA
Zvi Hashin Jun. 1964 37 p
(Contract Nonr-551(42))
(TR-4; AD-601629)

It is shown that macroscopic viscoelastic behavior of statistically homogeneous multiphase materials is related to macroscopic elastic behavior of similar materials via the correspondence principle. Several applications of the present theory for statistically isotropic materials are given. The general method applies equally well to statistically anisotropic materials, of which an important example is fiber-reinforced materials that are only transversely isotropic. D.E.W.

N64-32322 Utah U., Salt Lake City Microwave Device and Physical Electronics Lab.
EFFECTS OF GAMMA-IRRADIATION ON THE CHARACTERISTICS OF A RUBY LASER
Vern R. Johnson and Richard W. Grow Sep. 1964 145 p refs
(Grants NSF G-15017; NSF GP-843)
(NSF-7)

An increase in the absorption cross section responsible for optical pumping of a ruby laser is experienced as a result of γ-irradiation. As single-crystal ruby is irradiated with Co^{60} γ-rays, the usual absorption bands, which exist between 200 and 550 mμ, change from four distinct bands to one continuous absorption band inclusive of all wavelengths between 200 and 550 mμ. Similar work on sapphire, the host crystal for ruby, indicates that the majority of this increased absorption is experienced by the Cr^{+++} ion in ruby. Thermoluminescence data are also presented showing that electron traps, metastable states with a high potential barrier, are formed in ruby as a result of γ-irradiation. It is also found that the threshold energy for laser action increases in relation to the amount of γ-irradiation. Using the experimental data of this report as a basis, a model has been devised to explain mathematically what happens to the Cr^{+++} ions after γ-irradiation and how this affects laser action. Author

N64-32454 Compagnie Generale de Telegraphie sans Fil, Puteaux (France)
RESEARCH ON FERRITES INTENDED TO THE ELECTRIC SCANNING OF HERTZIAN BEAMS Quarterly Technical Status Report, Jan.–Mar. 1964
J. Nicolas [1964] 4 p
(Contract DA-91-591-EUC-3085)
(QTSR-2; AD-448750)

The influence of the Fe and Al ions in the A and B sites on the properties of compounds of the type Li_2O, $5(1-x)$ [$(1-y)$ Fe_2O_3, yAl_2O_3] $2z$ MnO_2 are being investigated, with emphasis on densities and magnetic moments. Samples of compounds corresponding to $x = 0.1$, $y = 0.05$ and 0.1, and $z = 0.2$ have been prepared for sintering at various temperatures in air and in pure oxygen, to investigate the effect of temperature on the mechanical properties of the products. M.P.G.

N64-32517 Union Carbide Corp., Parma, Ohio Carbon Products Div.
RESEARCH TO DETERMINE THE MECHANISMS CONTROLLING THE BRITTLE-DUCTILE BEHAVIOR OF REFRACTORY CUBIC CARBIDES Progress Report, May 1–Aug. 31, 1963
Wendell S. Williams and Robert G. Lye 15 Sep. 1963 51 p refs
(Contract AF 33(657)-10109)
(PR-2; AD-449222)

The yield-stress measurements at high temperatures have been extended to two carbides other than titanium: niobium and zirconium. The results are similar to those for TiC, as expected, but NbC is several times harder than either TiC or ZrC. A study was made of the influence of carbon vacancies on the resistivity of TiC. It was found that the effect is large: ≈ 16 $\mu\Omega$cm/at.% vacancies, or an order-of-magnitude larger than for vacancy scattering in the noble metals. The size of the effect is attributed to the small number of conduction electrons in TiC (~ 0.4/atom). The elastic properties of TiC and ZrC are shown to be rather similar to those of the Group VI transition metals, especially chromium, as may be expected on the simple "rigid band" model of the transition metals. Author

N64-32519 Miami U., Coral Gables, Fla.
DENSITY OF ICE AS A FUNCTION OF TEMPERATURE AND STRESS
Henri Bader Hanover, N.H., Cold Regions Res. and Eng. Lab., Aug. 1964 9 p refs
(SR-64; AD-448069)

The equations for calculating the density of ice of moderate porosity (density > 0.8) as a function of temperature and stress conditions are developed, and the values of parameters are calculated from the best available experimental data. Author

N64-32523 Korad Corp., Santa Monica, Calif.
RESEARCH ON COHERENT ELECTROMAGNETIC RADIATION MATERIALS Final Report

R. C. Pastor and R. H. Hoskins Wright-Patterson AFB, Ohio, ASD, 1 Aug. 1963. 128 p refs
(Contract AF 33(657)-8750)
(ASD-TDR-63-747; AD-417635)

The objective of this program has been the improvement of laser materials with respect to high output energy and power. Emphasis has been on the growth and evaluation of ruby. Results of detailed studies of the Verneuil (flame fusion) method of crystal growth and, in particular, the technology of the starting powder are presented. Several methods that have been developed for evaluation of rubies, including laser testing, are described. The solutions to several problems relating to crystal quality are given. A substantial improvement in the size and qulaity of ruby laser crystals was effected. Data obtained on other potential laser materials (Eu^{+3}: benzoyl acetonate and Mn^{+4} : α-A_2O_3) are included. Author

N64-32530 Oregon U., Eugene
MAGNETIC BREAKDOWN IN SOLIDS
U. N. Upadhyaya [1964] 11 p refs
(Contract Nonr-2771(05))
(TR-4; AD-605847)

Following the semiclassical approach, according to which an electron in the presence of a magnetic field moves in K-space around orbits that are the intersections of the surfaces of constant energy by planes normal to the magnetic field, H, an equation describing the general geometry of the electron orbits is proposed. Taking into account the fact that the wave vector *k* obeys a commutation relation in the presence of the magnetic field, the Schrödinger equation is set up for the problem. The stationary state solutions for the Schrödinger equation are obtained and are found to represent traveling waves converging and diverging to and from the origin. Author

N64-32555 Brown U., Providence, R.I. Div. of Engineering
SOME MECHANICAL EFFECTS OF GRAIN BOUNDARIES
M. A. Jaswon and M. H. Richman Jun. 1964 42 p refs
(Contract AT(30-1)-2394)
(TR-6)

A critical review is made of data relating to the role of grain boundaries in determining the mechanical properties of polycrystalline aggregates. Except at high temperatures, ceramic grain boundaries have a low stability with respect to the perfect crystalline structure, and exercise adverse mechanical effects by offering easy channels for crack propagation. This does not usually happen with metal grain boundaries, owing to their relatively high stability, and they can exert favorable mechanical effects by blocking the paths of glide dislocations emanating from within the grains. The extent of blocking depends largely upon the crystalline misorientation. Author

N64-32556 Cook Electric Co., Dayton, Ohio Inland Testing Labs.
QUARTZ CRYSTAL RELIABILITY STUDIES Quarterly Progress Report, 1 Oct. 1963–1 Jan. 1964
Carleton E. Jones [1964] 25 p
(Contract DA-36-039-AMC-02350(E))
(QPR-2; AD-432964)

Work performed in an investigation of the various factors that contribute to the failure of military-type quartz-crystal units (of the type used in frequency control applications) is outlined. The following crystal types are being tested: CR-36A/U in type HC-6/U holders at 16 Mc/sec and at 80 kc/sec; CR-36A/U in type HC-27/U holders at 16 Mc/sec; CR-47A/U in type HC-6/U holders at 250 kc/sec; CR-18A/U in HC-6/U holders at 1000 kc/sec; CR-26A/U in type HC-6/U holders at 400 kc/sec; CR-42A/U holders in type HC-6/U holders at 150 kc/sec; CR-52A/U in type HC-6/U holders at 40 Mc/sec; and CR-54A/U in type HC-6/U and HC-27/U holders at 75 Mc/sec. P.V.E.

N64-32558 General Electric Co., Schenectady, N.Y. General Electric Research Lab.
A RESEARCH INVESTIGATION OF THE FACTORS THAT AFFECT THE SUPERCONDUCTING PROPERTIES OF MATERIALS Progress Report, 15 Dec. 1963–15 Jun. 1964
R. W. Schmitt, P. S. Swartz, H. R. Hart, Jr., R. L. Fleischer, C. P. Bean, et al Wright-Patterson AFB, Ohio, AF Mater. Lab., Jun. 1964 52 p refs
(Contract AF 33(657)-11722)
(PR-2; AD-444406)

This report deals with topics important for understanding and controlling ac losses in both ordinary and hard superconductors. Losses at modest and high fields in high-field materials are governed by the critical current density, which is itself determined by the defect structure. Radiation-produced defects have proved to be useful both for dramatically improving the properties of some high-field superconductors and for studying the influence of defects on critical current density. Work is reported that helps delineate the conditions under which surface superconductivity is exhibited. The irreversible phenomena responsible for ac losses can also cause heating in wires and solenoids under noncyclic conditions, a circumstance that has been examined as part of these studies. Further work on ac losses in low applied fields, including a possible phenomenology of these losses, is presented. Author

N64-32565 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
EPITAXIAL FILM GROWTH Interim Engineering Progress Report No. 7, 10 Mar.–9 Jun. 1964
Rudolph Steckl et al Jul. 1964 92 p refs
(Contract AF 33(657)-9678)
(AMC-TR-7-995(VII); AMC-IR-7-995(VII); AD-448476)

The following research on epitaxial film growth of silicon materials is reported: (1) uniformity of the doping level in epitaxial films doped to a carrier concentration of 10^{19} atoms of phosphorus/cc; (2) film-thickness uniformity front-to-back for a large reactor tube; (3) description of 11 standard-graded doping profiles, and results on the first 5; (4) demonstration of the capability to epitaxially grow various precise geometries; and (5) development of a process for deposition of a passivating oxide as an integral part of the epitaxial-process sequence. M.P.G.

N64-32571 Stanford Research Inst., Menlo Park, Calif.
BARKHAUSEN EFFECT IN IRRADIATED PURE IRON AND NICKEL Final Report
S. I. Taimuty and J. B. Swedlund 28 Feb. 1964 44 p refs
(Contract Nonr-3615(00))
(AD-433849)

Pure iron and nickel samples procured from various sources were irradiated with 1.06×10^{18} or 3.63×10^{18} n/cm^2 (energies greater than 0.18 MeV) or with 3.55×10^{16} electrons/cm^2 (electron energy, 26 MeV). Changes in coercive force at these exposure levels were within experimental error (±10%). Changes in the Barkhausen effect (number and size distribution) were also within experimental error (about 10%) with three exceptions in the 16 experiments. One pair of iron samples exhibited an increase of about 30% in the number of Barkhausen pulses larger than about 3 ± 10^{-5} emu after 3.63×10^{18} n/cm^2. One pair of nickel samplex exhibited an increase of about 15% in pulses of about the same size after 1.06×10^{18} n/cm2. One iron sample

showed an increase of about 30% after electron irradiation, while a second identical sample showed essentially no change. The results indicate that the Barkhausen effect is a more sensitive indicator of radiation damage in magnetic materials than is the coercive force. Author

N64-32611 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF PHOTOADSORPTIVE EFFECT IN SEMICONDUCTORS
F. F. Vol'kenstein and I.V. Karpenko 27 Aug. 1964 17 p refs Transl. into ENGLISH from Poverkhnostnyye Svoystva Poluprovodnikov, Inst. Elektrokhimii, AN SSSR, 1962 p 114–127
(FTD-MT-64-205; AD-605733)

The sign of photoadsorptive effect in semiconductors depends on selection of the system, on the mode of experiment, and on the preparation of the sample for experiment. Thus, changing the mode of experiment (for instance, changing pressure in the gas phase) or modifying the method of preparation of the sample (for instance, introducing impurities into it) can change the sign of effect. This report offers formulas for establishing criteria for the determination of the sign of photoadsorptive effect depending on the values of the parameters characterizing the nature of absorbent and adsorbate, state of system on the whole, and mode of experiment. A.W.

N64-32625 International Resistance Co., Philadelphia, Pa.
PRECISION VOLUME RESISTOR Interim Development Report, Mar. 1–May 31, 1964
M. Burk, C. Huang, and K. M. Merz 20 Jun. 1964 39 p
(Contract NObsr-89439)
(IDR-4; AD-606704)

Precision volume resistor studies are reported. Nickel powders for use as the conductive phase in dispersed metal–ceramic resistor systems and copper and coprecipitated copper–nickel powders for fabricating pressed resistor bodies have been prepared. Resistor bodies made of V_2O_3-based compositions showed large negative temperature coefficients. Resistors based on carbon, palladium, alumina, and glass have been fabricated and tested. An increase in resistance with an increase in conductor content has been found due to a reaction between Pd, C, and silica forming Pd_2Si at temperatures above ≈ 1000° C. Therefore, new formulations that mature below 1000° C and the use of glasses that do not contain silica are under investigation. Load life characteristics of palladium–silver–ceramic and palladium–ceramic mixtures were found to be very satisfactory. M.P.G.

N64-32627 Systems Research Labs., Inc., Dayton, Ohio. Physical Chemistry Dept.
THE ELECTRICAL BEHAVIOR OF REFRACTORY OXIDES II Interim Technical Report, 1 Feb. 1963–15 Feb. 1964
R.W. Vest, J. A. Crawford, and W. C. Tripp Wright-Patterson AFB, Ohio, ARL, Aug. 1964 51 p refs
(Contract AF 33(657)-10815)
(ARL-64-122; AD-606883) OTS: $1.25

The research was directed toward achieving a more fundamental understanding of charge and mass transport mechanisms in refractory metal oxides. Special research apparatus and instrumentation was developed in order to carry out the experimental program. A computer-oriented study was conducted to assist in the analysis of dielectric loss data. The program was shown to be successful with a representative set of experimental measurements. The defect structure of monoclinic zirconia was investigated by measuring the oxygen partial-pressure dependence of the electrical conductivity and sample weight. Techniques were developed to calculate the degree of nonstoichiometry and the mobility of the charge carriers from electrical and weight change data. Author

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see:* 07 Chemistry; and 27 Propulsion.

N64-31675 Naval Ordnance Lab., White Oak, Md.
REVIEW OF NOL SENSITIVITY WORK APPLICABLE TO LARGE SOLID MOTOR EXPLOSION HAZARDS
Donna Price Oct. 1964 17 p refs
(NOLTR-64-148; AD-448349)

The purpose of this report is to summarize sensitivity work that is particularly relevant to the hazards encountered in large propellant motors. Previously unreported data on pressure loading by the detonation products of tetryl and references to reports, now in preparation, for the most recent work are presented. Author

N64-31693 Malaker Labs., Inc., High Bridge, N.J.
KINETIC STUDY OF ROCKET EXHAUST GASES
1 Oct. 1963 4 p
(Contract DA-30-069-ORD-2918)
(PR-6; AD-421967)

Breadboard optical equipment was assembled for spectrographic determination of combustion products and temperature in well-defined solid-propellant combustion zones. The resulting schemes were reconstructed to improve operability and accuracy. Some specific changes are as follows. The moving slit mechanism was replaced by a fixed slit and a motor-driven final mirror. All system controls were assembled into two adjacent control panels. The sequence camera now monitors pressure, gas flow, propellant pusher position, time, and actuation of diagnostic equipment, as well as the burning rate. All position readouts now employ Selsyns. A high-range flowmeter was added. All these changes were tested, but some are not in final form. D.E.W.

N64-31741 Shell Development Co., Emeryville, Calif.
VAPORIZING AND ENDOTHERMIC FUELS FOR ADVANCED ENGINE APPLICATION. PART I; PRELIMINARY STUDIES OF CATALYZED REACTIONS AND THERMAL STABILITIES OF HYDROCARBON FUELS Technical Documentary Report, Jun. 1963–Jun. 1964
A. C. Nixon, I. S. Bjorklund, R. D. Hawthorn, H. T. Henderson, and A. W. Ritchie Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Sep. 1964 154 p refs
(Contract AF 33(657)-11096)
(APL-TDR-64-100, Pt. I; AD-605840)

Studies leading toward the development of specifications for heat-sink fuels for hypersonic aircraft are reported. Consideration of the effect of design parameters on the conditions under which endothermic reactions can be carried out has led to the conclusion that space velocities of 50 or higher would be necessary due to volume limitations in high-speed aircraft. Rate considerations favor catalytic reactions. Conditions include temperatures to 1300° F, pressures to 10 atmospheres, and space velocities to 100. Using a platinum on alumina

catalyst, almost complete conversion of MCH was achieved with a maximum heat sink of 2000 Btu/lb at 1300° F. Chromia on alumina was a less successful catalyst, but with propane it yielded a total heat sink at 1200° F of 1600 Btu/lb. Thermal stability studies include the modification of two types of cokers to minimize contamination possibilities and improve reproducibility. The thermal stabilities of samples of n-dodecane, toluene, and methylcyclohexane decreased in the order named. Author

N64-31820 Monsanto Research Corp., Everett, Mass.
RESEARCH ON THE MECHANISM OF THERMAL DECOMPOSITION OF HYDROCARBON FUELS Technical Documentary Report, 15 Nov. 1962–15 Nov. 1963
Bela M. Fabuss, Alexander S. Borsanyi, Dennis A. Duncan, Ralph Kafesjian, and John O. Smith Wright-Patterson AFB, Ohio AF Aero Propulsion Lab., Aug. 1964 129 p refs
(Contract AF 33(657)-8193)
(ASD-TDR-63-102, Pt. II; AD-605817)

The decomposition and particle formation of 28 naphthenic and 8 paraffinic hydrocarbons were studied. The decomposition was approximately a first-order kinetic process, although self-acceleration was observed with most monocyclic hydrocarbons, and self-inhibition was observed for polycyclic hydrocarbons. Pressure increased the decomposition rate. A detailed study of the effects of organosulfur contaminants was made. These contaminants inhibited the cracking of naphthenes and straight-chain paraffins and accelerated the cracking of branched paraffins. An increase in contaminant concentration and an increase in the number of methyl substituent groups on a hydrocarbon increased this effect. Author

N64-31926 Philco Corp., Blue Bell, Pa. Research Labs.
INTERNAL ENVIRONMENT OF SOLID ROCKET NOZZLES Final Technical Report
F. C. Price, V. A. Marple, R. H. Williams, R. A. DuPuis, H. L. Moody et al 30 Jul. 1964 214 p refs
(Contract AF 04(611)-9072)
(U-2709; RPL-TDR-64-140; AD-606393)

Solid rocket motor nozzle environment was studied in cold flow modeling and in motor firings. The emphasis in the work was on the effects of the condensed phase in wall impingement and radiation. In motor firings using H_2-O_2-Al_2O_3-H_2O emissivity values for the alumina were determined. Then radiation heat-flux scaling relationships were developed for application to any size motor. Particle impingement was studied in firing with a molybdenum nozzle fitted with thermocouples from which local transient heat-flux data were developed. High heat-flux rates due to impingement were determined. In cold flow studies particle impingement rates and static pressure values for input to corrective analysis were determined. Analyses of heat-flux modes in a large motor nozzle and in a gimbaled nozzle were determined. A large part of the work involved technique development in handling micron-sized particles in firings and in cold flow. A particle sampler was developed for sampling motor exhausts. Author

N64-31982 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
REDUCTION OF ALUMINUM OXIDE BY PROPELLANT COMBUSTION GASES AT HIGH-TEMPERATURES
S. G. Gibbins and B. Siegel 1 Sep. 1964 14 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-160; TDR-269(4210-10)-7; AD-606158)

The effect of hydrogen on crystalline Al_2O_3 was studied at pressures ranging from 2 mm to approximately atmospheric at 1700° to 1800° C. At the higher pressures there was no observable reduction of the alumina in the presence of hydrogen alone. However, when graphite was also present, aluminum carbide was formed at an appreciable rate. The formation of the carbide is explained on the basis of a reaction between graphite and H_2 to form methane, which reduces the alumina. At very low pressures hydrogen alone did reduce alumina appreciably, but the product was not identified. Alumina was also reduced at a small but observable rate by carbon monoxide at 1700° C and a pressure of ~0.5 atm. The implications of these phenomena for propulsion are discussed with reference to their effects on propellant performance and missile detection. Author

N64-32052 Aerojet-General Corp., Azusa, Calif. Chemical Div.
APPLICATIONS OF STORABLE PROPELLANTS TO SPACE FLIGHT
S. B. Kilner and Louis R. Rapp [1961] 37 p refs *Its* Contrib. No. 225

The types of space mission to which storable propellants are applicable are discussed, requirements on the propellants are outlined, and some special environmental factors in space are mentioned. Various storable propellants and storable systems are described and compared with other propulsion systems. Author

N64-32125 Aeronutronic, Newport Beach, Calif. Research Lab.
AN EXPERIMENTAL PROGRAM FOR OBTAINING THE THERMODYNAMIC PROPERTIES OF PROPELLANT COMBUSTION PRODUCTS Fifth Quarterly Technical Report
D. L. Hildenbrand, L. P. Theard, W. F. Hall, and N. D. Potter 15 Sep. 1963 38 p refs
(Contract NOw-61-0905-c; ARPA Order-22-62)
(U-2289; AD-421609)

The vapor pressures of LiF, LiCl, MgF_2, and $MgCl_2$ have been measured by the torsion-effusion method. The lithium halide vaporization data have been analyzed to yield heats of sublimation of monomer and dimer species that are consistent with available data on vapor composition, heats of dimerization, and the normal boiling points. Derived heats of sublimation of monomer and dimer at 298° K are 66.5 and 71.6 kcal/mole for LiF, and 51.0 and 52.0 kcal/mole for LiCl, respectively. An analysis of the data obtained here and other vaporization data on the magnesium halides indicates that the available entropy and free-energy functions for MgF_2(g) and $MgCl_2$(g) may be low by 4 to 5 cal/mole deg. Possible reasons for the discrepancy are discussed. The heats of sublimation of MgF_2(g) and $MgCl_2$(g) at 298° K are 93 and 59 kcal/mole, respectively. Author

N64-32241 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMBUSTION IN LIQUID-PROPELLANT ROCKET MOTORS
Yu. Kh. Shaulov and M. O. Lerner 31 Jul. 1964 240 p refs
Transl. into ENGLISH of the book "Goreniye v Zhidkostnykh Raketnykh Dvigatelyakh" Moscow, Gos. Nauch.-Tekhn. Izd. Oborongiz, 1961 p 1–194
(FTD-MT-64-272; AD-605460)

This book contains seven chapters as follows: Chapter I, "Elements of Kinetics of Chemical Reactions"; Chapter II, "Homogeneous and Heterogenous Combustion"; Chapter III, "Kinetics of Chemical Reactions in Flame"; Chapter IV, "Carburation"; Chapter V, "Steady-State Regime of Burning"; Chapter VI, "Instability of Combustion Process"; Chapter VII, "Simulation of Process of Burning." E.C.

N64-32281 Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TASK R Quarterly Progress Report No. 18, 1 Jul.–30 Sep. 1963
A. A. Westenburg et al [1963] 40 p refs
(Contract NOw-62-0604-c; ARPA Order 22-63)
(SR-4-2; AD-421822)

Research on the physicochemical and fluid-dynamic behavior of high-temperature, high-speed gas flows such as occur in most advanced propulsion systems is reported in the following areas: (1) dissociated gas studies, considering the possibilities of microwave saturation in the electron-spin-resonance spectra of gas-phase atoms; (2) instrumentation for molecular beam chemical kinetic studies; and (3) development of an infrared spectrographic technique for *in situ* measurement of CO_2 concentrations in rocket exhaust. M.P.G.

N64-32284 Coordinating Research Council, Inc., New York, N.Y.
AN INVESTIGATION OF THE PERFORMANCE OF JET ENGINE FUELS FOR SUPERSONIC TRANSPORT AIRCRAFT Fourth Quarterly Technical Report, Nov. 1962–Jan. 1963
1 Feb. 1963 15 p
(Contract AF 33(657)-8862)
(LD-121)

Progress is reported in the following areas: (1) construction of the airframe and aircraft engine fuel system test rig; (2) analysis of the environmental conditions for a typical supersonic transport mission profile; (3) arrangements for small-scale studies to be carried out in various fuel coker test devices; (4) review of available test techniques for measuring key physical properties of aircraft turbine fuels; and (5) selection, storage, and procurement of fuels for the various phases of the program. Author

N64-32396 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING THE METHODOLOGY OF EXPERIMENTAL INVESTIGATION OF THE TOTAL KINETICS OF COMBUSTION OF GASES
Z. S. Leont'yeva 30 Mar. 1964 10 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 3, no. 2, 1960 p 12–16
(FTD-MT-63-238; AD-602592)

The methodology is based on the rapid mixing of a gas mixture with the products of combustion during the creation of a sufficiently uniform field of temperatures and concentrations and almost isothermal conditions of transformation. An experimental check on a sample of carbon monoxide in the temperature interval 1000° to 1250° C showed conformity with reliable published data. Author

N64-32472 Shell Development Co., Emeryville, Calif.
FUNDAMENTAL RESEARCH ON ADVANCED OXIDIZERS Quarterly Technical Report No. 6, Mar.–May 1964
R. P. Nielsen, C. D. Wagner, A. M. Benson, J. N. Wilson, F. S. Mortimer et al [1964] 40 p refs
(Contract DA-31-124-ARO(D)-54; ARPA Order 402)
(S-13921; AD-448622)

Research reported includes the following: (1) determination of irradiation products of NF_3, N_2F_4, a mixture of NF_3 and $F_2C{=}CH_2$, a mixture of xenon and chlorine, and a mixture of SF_6 and N_2F_4; (2) efforts to synthesize NF- or NOF-containing molecules in a chemical shock tube; (3) search for parameters useful in correlating and predicting bond dissociation energies; (4) preliminary modifications of the extended Hückel molecular orbital calculation procedure to improve its utility in predicting heats of atomization; and (5) estimation of second-neighbor repulsion energies in the alkali halides by combining information from compressibility data and fundamental lattice vibration frequency data. Reasonably self-consistent results were obtained for the chlorides, bromides, and iodides; some possible reasons for the unexpected behavior of the fluorides are discussed. M.P.G.

N64-32482 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
NONEQUILIBRIUM RECOMBINATION IN NOZZLES. FUNDAMENTAL RECOMBINATION PROCESSES IN LOX-HYDROGEN, FLUORINE-HYDROGEN, AND FLOX-HYDROGEN PROPELLANTS
S. W. Mayer, E. A. Cook, and L. Schieler 18 Sep. 1964 33 p refs
(Contract AF 04(695)-269)
(TDR-269(4210-10)-6; SSD-TDR-64-139; AD-606703)

The significant nozzle recombination steps are tabulated for combustion products formed by LOX–hydrogen, fluorine–hydrogen, and FLOX–hydrogen propellants. Kinetic data for each of these 23 nozzle reactions are summarized in terms of the rate constants, $k_i = A_i T^{\eta_i} \exp(-E_i/RT)$. A systematic basis is presented for selecting the significant nozzle reactions of atoms, radicals, and molecules for inclusion on the data tapes of computer programs for nonequilibrium calculations of propellant performance. The relative importance of the preexponential factor in high-temperature recombinations is emphasized. A method is given for reducing the number of equations needed in nonequilibrium performance calculations involving termolecular recombinations. A procedure for calculating concentrations of light-emitting excited states in the exhaust is presented. Ionization constants for the formation of cations, anions, and electrons in nozzle gases are computed and discussed briefly. Author

N64-32503 Aerochem Research Labs., Princeton, N.J.
NEGATIVE ION FORMATION IN THE ATOMIC OXYGEN-ACETYLENE REACTION
William J. Miller and A. Fontijn Sep. 1964 7 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(AC-1-P; AD-448077)

The formation of large concentrations (10^{11} to 10^{12} cc^{-1}) of negative ions observed in low-pressure atomic oxygen–acetylene reactions is attributed to electron attachment processes. This medium is therefore being used to investigate both the natural ions of the reaction environment and the ions formed by additives and impurities. Individual ion-current profiles indicate that the negative charge carriers in the luminous zone are mainly electrons. Negative ions become important charge carriers only in the gases surrounding the reaction zone. Comparisons of results obtained in low (1 to 10 torr) and atmospheric pressure indicate that both electron attachment and ion clustering are favored by lower temperatures and higher pressures. M.P.G.

N64-32518 Naval Radiological Defense Lab., San Francisco, Calif.
DIFFUSION-CONTROLLED IGNITION OF ORGANIC SOLIDS BY INTENSE RADIANT ENERGY
Stanley B. Martin Apr. 1964 23 p refs Presented at the 1964 Spring Meeting of the Western States Section of the Combustion Institute, Stanford U.
(WSS/CI Paper-64-7; AD-449236)

Within the ranges of irradiance levels and material thicknesses for which ignition behavior is governed by the diffusion of heat, spontaneous-flaming ignition of organic solids has been shown to depend upon the temperature rise of the exposed surface. By way of contrast, persistence of ignition depends upon the average or "relaxed" temperature of the entire thickness of exposed solid. In the case of cellulose, the measured ignition temperature is approximately 600° C. The transient temperature profile, a function of classical heat-conduction parameters, is heavily perturbed by heats of reaction (apparently both endothermic and exothermic) and heats of phase change. Analysis of the volatile pyrolysis products from cellulose indicates a definite change in composition occurring at about the time when ignition would occur in air. Significance of this change in terms of the ignition of cellulose is discussed. Author

N64-32541 Naval Ordnance Lab., White Oak, Md.
REVIEW OF NOL SENSITIVITY WORK APPLICABLE TO LARGE SOLID MOTOR EXPLOSION HAZARDS
Donna Price Oct. 1964 17 p refs Presented at the Large Solid Motor Explosion Hazards Conf., 15 Apr. 1964
(NOLTR-64-148; AD-448349)

Large scale gap tests, used in the general field of explosive sensitivity studies to determine minimum or initiating pressures for materials, were applied to the specific problems of solid propellant hazards. The use of the test indicated the following: (1) the relative shock insensitivity of the integral propellant as contrasted to the shock sensitivity of loosely compacted propellant, thus underlining the importance of breakup of the propellant in any accident, and (2) a good correlation between gap test results and those from field tests of propellant detonability, although gap test results are not sufficient for propellant burning sensitivity. The calibration of the test apparatus and previously unreported data on pressure loading by detonation products of tetryl are presented. D.S.G.

N64-32553 Midwest Research Inst., Kansas City, Mo.
STRUCTURAL STUDIES OF INORGANIC OXIDIZERS Annual Summary Report, 1 Jun. 1963–31 May 1964
29 Jun. 1964 41 p refs
(Contract AF 04(611)-9372; ARPA Order 24)
(RPL-TDR-64-98; AD-444937)

Liquid OF_2 and NF_3 amd OF_2-NF_3 mixtures have been studied. The EPR, IR, and flash photolysis investigations have been undertaken in the search for stable ions such as NF_4^+, NF_2^+, and OF^+. Results of these studies are reported. A variable thickness IR cell for low-temperature studies and a specially fabricated cryogenic dewar are described. In addition, the purification of commercial oxidizer gases is discussed. Author

N64-32632* Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF O_3F_2 AND THE HYPERGOLIC BIPROPELLANT LH_2/LO_2:O_3F_2
A. B. Amster, E. L. Capener, L. A. Dickinson, and J. A. Neff 15 Jun. 1964 52 p refs
(Contract NASr-49(00))
(NASA-CR-54072; SRI-PRU-4391) OTS: $3.00 fs; $0.50 mf

The properties of ozone fluoride and its solution in liquid oxygen have been studied. Neat ozone fluoride has been shown to be nondetonable at a diameter of 1 inch. The solubility relationship of ozone fluoride in liquid oxygen versus temperature has been determined. Ignition studies made by using quartz and steel combustion chambers (500-thrust) have shown that hypergolic ignition occurs between hydrogen and liquid oxygen containing 0.095% ozone fluoride. Both a single-element triplet injector and a multielement coaxial stream injector were studied. Author

N64-32645 Chance Vought Corp., Dallas, Tex. Astronautics Div.
INTEGRATED BACK-PACK MANEUVERING UNIT PROPULSION STUDY AND EXHAUST PLUME HEATING ANALYSIS Astronautics Engineering Report 00.252, Dec. 1962–Jun. 1963
S. C. Walker, C. L. Pratt, and F. H. Goodnight Wright-Patterson AFB, Ohio, ASD, Sep. 1963 237 p refs
(Contract AF 33(657)-10408)
(ASD-TDR-63-729; AD-449612)

Two technical problems related to the Astronaut Maneuvering Unit are treated. The problems are heating associated with the impingement of the rocket exhaust on space suit surfaces, and the performance of inert heated gases as propellants. Methods for predicting rocket exhaust heating rates in space are presented, and results are compared with test data. Effects of plume heating of an H_2O_2 monopropellant exhaust from a typical motor placement are summarized. The results obtained from several heated gas propellant tests are reported and compared to theoretically predicted performance. The analytical and experimental techniques utilized are discussed in detail. The refrigerants Freon 115 and Freon C318 show the highest density impulse and the lowest weight. Author

N64-32647 Little (Arthur D.) Inc., Cambridge, Mass.
COMBUSTION INSTABILITY STUDIES
Aubrey C. Tobey [1964] 48 p refs Presented at the 1964 Spring Meeting, Western States Sect., The Combust. Inst., Stanford U., Apr. 1964
(Contract AF 49(638)-1120)
(AD-449764)

This paper contains analytical and experimental data for the flame-piloting mechanism in rocket combustions and the effect of external disturbances on it, with emphasis on the recirculation zone in a coaxially fed rocket system using inert injection, for improved control methods of high-frequency combustion oscillation of rocket engines. Variables of local concentration and temperature, as well as rocket-chamber pressure variations with time, have been studied as functions of oxygen to fuel ratio, chamber length, injection configuration, inert-gas injection rate, and position of inert gas injection relative to the injector face. A primary reaction zone bordered on one side by a fuel-rich zone and on the other by an oxygen zone was indicated by data, with an increase of reactant concentration with the distance from the primary reaction zone. The rates of mass transfer to the primary reaction zone are derivable from the classical diffusion theory. G.G.

N64-32668 Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
SPACE VEHICLE PROPULSION COMPARTMENT FIRE HAZARD INVESTIGATION, VOLUME I
Paul J. Martinkovic Jul. 1964 88 p
(RPL-TDR-64-103; AD-607131)

Tests were conducted under various potentially hazardous conditions at altitudes from 25 000 to 200 000 feet. No attempt was made to define ignition characteristics of the combustible combinations investigated. The test specimens were N_2O_4, N_2H_4, and 50% unsymmetrical dimethylhydrazine and 50% hydrazine (0.5 UDMH-0.5 N_2H_4). Other combustibles, i.e., hydraulic fluid, lubricating oil, and grease were tested in combinations with a fuel and oxidizer. Nonmetallic materials were also tested in combination with the oxidizer and fuels

Analysis of the data revealed that propellant leakage within closed compartment areas can result in fires and explosions. In addition, compartment overpressurization can also occur from reaction of the propellants and the rapid vaporization of propellants when subjected to low-pressure conditions. Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-31453* General Electric Co., Philadelphia, Pa. Space Sciences Lab.
PERFORMANCE STUDY OF A REPETITIVELY PULSED TWO-STAGE PLASMA PROPULSION ENGINE Summary Report
B. Gorowitz, P. Gloersen, A. Ruess, and J. Kenney 17 Aug. 1964 123 p refs *Its* Rept. No. 214-S01
(Contract NAS3-3570)
(NASA-CR-54064) OTS: $4.00 fs; $1.00 mf

The major fraction of the program was devoted to increasing the energy term representing work done on the plasma, $\int i^2 L\,dt$, with respect to the loss term, $\int i^2 R\,dt$, or, in other words, by increasing L with respect to R. Several possible means for increasing L were explored, i.e., by altering engine geometry, altering propellant distribution in the engine, and increasing peak currents (since, under certain conditions, L was found to be proportional to i) by increasing circuit capacitance and decreasing initial circuit inductance. The energy efficiency trends were monitored by means of exhaust stream calorimetry. Of the above variations explored, propellant distribution and engine geometry proved by far to be the most fruitful. Author

N64-31563* National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL STUDIES ON LATERAL THRUST COMPONENTS IN SOLID FUEL PROPULSION UNITS [EXPERIMENTELLE UNTERSUCHUNGEN UBER QUERSCHUBKOMPONENTEN BEI FESTSTOFFTRIEBWERKEN]
W. Buschulte and K. Schadow Sep. 1964 20 p refs Transl. into ENGLISH of a paper presented at the third European Space Flight Symp., Stuttgart, 21–24 May 1963
(NASA-TT-F-9046) OTS: $1.00 fs; $0.50 mf

Lateral forces complicate the thrust control of rockets or reduce accuracy. These forces depend on asymmetrical expansion of the combustion gases, causing an unequal distribution of the flow properties over the nozzle area. The lateral forces were first measured in a thrust stand, and then derived from the distribution of the flow properties over the nozzle area by the schlieren method. Some shocks were artificially created in a two-dimensional transparent nozzle, the slopes of the shocks giving the velocity of the flow. At the same time, the pressure was measured at some points. With this measuring device different nozzles were studied to find out how the conditions of the flow before the throat (e.g., pressure, velocity, direction of flow) influence the conditions of the flow behind the throat (e.g., unequal distribution of the flow properties, asymmetrical separation of the flow in overexpanded nozzles). The lateral forces of some different nozzles were measured. Author

N64-31577 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 19, 1–31 Oct. 1963
10 Nov. 1963 79 p
(Contract AF 04(695)-393)
(Rept.-393-01M-19; AD-445060)

This report on the Gemini launch vehicle program pertains to "Engine Design"; "Engine Development"; "Malfunction Detection System"; "Flight Instrumentation System"; "Flight Operations"; "Aerospace Ground Equipment"; "Reliability and Quality Control"; "Product Support"; "Pilot Safety Program"; "Weight and Balance"; and "Fabrication." G.G.

N64-31578 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 20, 1–30 Nov. 1963
10 Dec. 1963 57 p
(Contract AF 04(695)-393)
(Rept.-393-01M-20; AD-445055)

The following are discussed in this report: "Engine System Design Progress"—engine assembly, telemetry instrumentation, controls harness installation, autogenous system, malfunction detection systems, landline instrumentation, engine frame, and analytical activities; "Component Design Progress"—ablative skirt, flared tube fittings, and problem areas; "Engine Development"—R & D and production engine tests; "Gemini Malfunction Detection Systems"—qualification programs and reliability and development; "Flight Instrumentation System"; "Aerospace Ground Equipment"; "Age Design and Development"; "Product Support"; "Pilot Safety Program"; "Weight and Balance"; and "Fabrication." G.G.

N64-31579 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 21, 1–31 Dec. 1963
10 Jan. 1964 65 p
(Contract AF 04(695)-393)
(Rept.-393-01M-21; AD-445053)

Progress in developing and fabricating components for the Gemini Launch Vehicle engine system and associated ground equipment is reported in the following areas: engine design and development, malfunction-detection system, flight-instrumentation system, flight operations, aerospace ground equipment, reliability and quality control, product support, pilot-safety program, weight and balance, and fabrication. Pertinent schedules and production analysis graphs for the first- and second-stage engines are included. M.P.G.

N64-31580 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 22, 1–31 Jan. 1964
7 Feb. 1964 71 p
(Contract AF 04(695)-393)
(Rept.-393-01M-22; AD-448605)

Overall progress is described for the engine design in terms of general paperwork. Specific items of progress are reported on the first-stage engine design, second-stage engine design, thrust-chamber design, and rotating-machinery design. Results are reported from tests of the R and D engine and from field-test feedback tests. Fabrication progress on the first-stage and second-stage engines and on aerospace ground equipment is described in detail. Progress is also reported on the Gemini

malfunction-detection system; the flight-instrumentation system; flight operations; aerospace ground equipment; reliability and quality control; product support; pilot safety; and weight, balance, and structures engineering. D.E.W.

N64-31581 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 23, 1–29 Feb. 1964
10 Mar. 1964 78 p
(Contract AF 04(695)-393)
(Rept.-393-01M-23; AD-448606)

This report on the Gemini launch-vehicle program pertains to "Engine Design"; "Engine Development"; "Malfunction Detection System"; "Flight Instrumentation System"; "Flight Operations"; "Aerospace Ground Equipment"; "Reliability and Quality Control"; "Product Support"; "Pilot Safety"; "Weight, Balance and Structures Engineering Activities"; and "Fabrication." G.G.

N64-31582 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 24, 1–31 Mar. 1964
10 Apr. 1964 72 p
(Contract AF 04(695)-393)
(Rept.-393-01M-24; AD-448601)

The following are discussed in this report: "Engine Design"—first- and second-stage engine design, engine thermodynamic analysis, engine dynamic analysis, component design, and problem areas and rotating machinery; "R+D Engine Development Tests"; "Malfunction Detection System"—field-test feedback; "Flight Operation"—engine-test directives and general activities in support of field activation; "Aerospace Ground Equipment"—recommendation data, revision of procedural data, and AGE design and development; "Reliability and Quality Control"—quality-control operations; "Product Support"—human engineering, product support, and logistics and surveillance engineering status; "Pilot Safety"—abort panel; "Weights & Balances"; and "Fabrication." G.G.

N64-31583 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE PROGRAM Monthly Progress Report No. 26, 1–31 May 1964
10 Jun. 1964 75 p
(Contract AF 04(695)-393)
(Rept.-393-01M-26; AD-448607)

The program status is reported in these areas: engine design, development tests, malfunction-detection system, flight-instrumentation system, flight operations, aerospace ground equipment, reliability and quality control, product support, pilot safety, weight and balance, and fabrication. D.E.W.

N64-31584 Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Plant
GEMINI LAUNCH VEHICLE Reliability Monthly Report No. 12, 1–31 Oct. 1963
16 Dec. 1963 362 p
(Contract AF 04(695)-393)
(Rept.-393-3.4-M-12; AD-445056)

Tests are summarized for the Gemini engines YLR87-AJ-5, YLR87-AJ-7, YLR91-AJ-5, and YLR91-AJ-7. Hardware discrepancies and out-of-control conditions are listed. Reliability problems are summarized and discussed. R.L.K.

N64-31601 Air Force Office of Scientific Research, Washington, D.C.
ADVANCED PROPULSION CONCEPTS, VOLUME 1 Proceedings of the Third Symposium
New York, Gordon and Breach Sci. Publishers, 1963 429 p refs Symp. held in Cincinnati, Ohio, 2–4 Oct. 1962

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2. QUEST FOR HEAVY PARTICLE ELECTRIC PROPULSION R. E. Hunter (Wright-Patterson AFB) p 19–33 refs (See N64-31602 23-27)

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5. NASA RESEARCH ON RESISTANCE HEATED HYDROGEN JETS John R. Jack (NASA. Lewis Res. Center) p 75–92 (See N63-10971 02-27)

PLASMA PROPULSION

6. IMPULSIVE MHD DEVICES AS SPACE ENGINES R. H. Lovberg (Gen. Dynamics/Astronautics) p 95–113 (See N64-31605 23-27)

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10. MOMENTUM TRANSFER THROUGH THE ELECTRIC FIELDS R. G. Meyerand, Jr. (United Aircraft Corp.) p 177–197 refs (See N64-31609 23-27)

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11. LARGE TURBO-NUCLEAR SPACE POWER SYSTEMS M. A. Zipkin (Gen. Elec. Co.) p 201–259 (See N64-31610 23-06)

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NUCLEAR FUSION PROPULSION CONCEPT

14. GASEOUS CORE REACTORS R. V. Meghreblian and H. J. Stumpf (JPL) p 293–339 (See N64-31613 23-27)

NUCLEAR FISSION PROPULSION CONCEPTS

15. CONTROLLED FUSION PROPULSION J. S. Luce (Aerojet-General Nucleonics) p 343–380 refs (See N64-31614 23-27)

16. FUSION PLASMA PROPULSION SYSTEM W. L. Linlor and M. U. Clauser (Hughes Res. Labs.) p 381–407 refs (See N64-31615 23-27)

17. FEASIBILITY OF INTERSTELLAR TRAVEL D. F. Spencer and L. D. Jaffe (JPL) p 409–432 refs (See N64-31616 23-29)

N64-31602 Aeronautical Systems Div., Wright-Patterson AFB, Ohio AF Propulsion Lab.
QUEST FOR HEAVY PARTICLE ELECTRIC PROPULSION
R. E. Hunter *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 19–33 refs (See N64-31601 23-27)

Although the primary motivation for heavy-particle electrical-propulsion research is the attainment of efficient operation in the intermediate range of specific impulse (1000 to 5000 seconds), the concept gives promise of efficient operation at any desired specific impulse due to the relatively small energy per unit of expellant mass required for the charging process. Some of the approaches being pursued to achieve stated objectives of quantity and quality are: (1) induction or bombardment charging of uniformly sized powders of less than 800-angstrom-units diameter; (2) electrical dispersion of liquids; and (3) forming droplets by condensation from the vapor phase, with charging either before or after condensation. The problems are those of charge–mass ratio distribution (including ionic current and neutral loss), low source current, and agglomeration. A.W.

N64-31603 Space Technology Labs., Inc., Redondo Beach, Calif.
STL HEAVY PARTICLE PROPULSION PROGRAM
Ernest Cohen *In* AFOSR Advanced Propulsion Concepts, Vol. 1 p 35–51 refs (See N64-31601 23-27) Sponsored by AF

The colloidal charged droplet program at STL has been concerned with forming droplets of metallic and nonmetallic liquids from the bulk liquid in a single step, namely, by passing the liquid through a capillary metal tube having a high potential. The resulting droplets have charge–mass ratios ranging from about one hundred to several thousand coulombs per kilogram. They are of interest for electrostatic propulsion because they would permit higher voltages to be used, and would provide specific impulses in the range of 2000 sec where efficient performance is difficult to obtain by other means. Of the variety of liquids examined, the organic liquids with ionic conductors (e.g., glycerol and antimony trichloride) and the low-melting-point metals (e.g., Woods Metal) were the most promising. Source tubes were stainless steel, 0.001 to 0.020 i.d., and were used either open or packed with wire, glass wool, or Fiberfrax. The independent variables were accelerating voltage, fluid pressure, fluid temperature, and, at times, the introduction of an rf modulation. R.L.K.

N64-31604 Ion Physics Corp., Burlington, Mass.
CONDENSATION COLLOID PROPELLANTS FOR ELECTROSTATIC PROPULSION
A. Lucille Coy *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 53–73 refs (See N64-31601 23-27)
(Contract AF 33(657)-8743)

Described is an experimental investigation to determine the operating characteristics of a controlled-growth ion source, using three different types of ionizer—the contained arc, the free arc, and a corona. The last two offer greater possibilities of producing colloidal ions of the required charge-to-mass ratio. R.L.K.

N64-31605* General Dynamics/Astronautics, San Diego, Calif.
IMPULSIVE MHD DEVICES AS SPACE ENGINES
R. H. Lovberg *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 95–113 (See N64-31601 23-27) Sponsored by NASA

Discussed are the mechanism of plasma acceleration, MHD instabilities, and the design of the electrical circuit that drives the accelerator. An experimental coaxial plasma accelerator was constructed to study the physical process of accelerating a plasma between two electrodes. There was evidence that a plasma gun may be operated without destructive electrode losses; short, strong acceleration seems to be favorable for this. However there is some loss of electromagnetic energy due to a tendency of the gun to "crowbar," i.e., to set up a secondary discharge near the insulator at the rear of the barrel after one-half cycle of the oscillating gun current. Instabilities occur quite easily, but may be avoided. The physical acceleration process apparently involves a relative motion of plasma and magnetic field; however, this does not seem to result in heat dissipation but rather results in a deposit of directed energy in the propagation direction. The greatest impediment to practical use of plasma propulsion may lie in the difficulty of obtaining suitably long-lived and reliable components. R.L.K.

N64-31606 Avco-Everett Research Lab., Everett, Mass.
PLASMA FLOW IN A MAGNETIC ANNULAR ARC NOZZLE
R. M. Patrick and W. E. Powers *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 115–137 refs Previously Announced as Amp-86; see N62-16290 16–21 (See N64-31601 23-27)
(Contract AF 49(638)-659)

Experiments with the objective of accelerating a plasma with $\vec{J} \times \vec{B}$ forces and of achieving a high directed energy compared to energy invested in ionization indicated the following: (1) A stable arc can be made in a coaxial configuration with an axial field that produces a steady, azimuthally uniform plasma. (2) A considerable amount of directed swirl energy can be added to the plasma, and a major portion of this energy can be converted in a 10° half-angle nozzle, the flow being dominated by centrifugal effects. (3) The plasma-flow properties are different in a wide-angle nozzle where the plasma swirl does not dominate the flow. (4) A crude estimate of the radial and azimuthal current distribution indicates that the plasma-density profile is controlled by the circulating Hall currents. (5) The estimated ratio of azimuthal to radial currents j_θ/j_r indicates that $\omega_e\tau_e$ is of the order of 5 to 10. (6) The device can produce an average exhaust velocity corresponding to a specific impulse of nearly 600 sec in argon with an overall thrust efficiency equal to 25%. R.L.K.

N64-31607 Aerospace Corp., El Segundo, Calif.
PLASMA ACCELERATION BY TRAVELING MAGNETIC FIELD
R. M. Head, R. H. Huddlestone, E. B. Mayfield, and R. X. Meyer *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 137–150 refs (See N64-31601 23-27)

Described in detail are two plasma acceleration systems that were developed, using 10- and 25-kilovolt helical transmission lines. R.L.K.

N64-31608 Avco-Everett Research Lab., Everett, Mass.
MOMENTUM TRANSFER THROUGH MAGNETIC FIELDS
G. S. Janes, J. Dotson, and T. Wilson *In* AFOSR Advanced Propulsion Concepts, Vol. 1 p 153–176 refs (See N64-31601 23-27)
(Contract AF 49(638)-659)

This paper discusses the electrostatic acceleration of electrically neutral plasma under conditions where the energy input is produced by an applied electrostatic field parallel to the direction of plasma acceleration, while the momentum input

is produced by an applied magnetic field with components perpendicular to the direction of plasma acceleration. This acceleration mechanism can occur in a domain called the electric, magnetic region of plasma physics. In this domain both the ion gyro radius and the electron mean free path between collisions are large relative to the apparatus size, while the electron gyro radius and the Debye shielding distance are still relatively small. Under these conditions, the motion of electrons perpendicular to magnetic field lines is inhibited, thereby permitting the plasma to sustain an electric field, which is associated with the forces necessary to accelerate the ions. Author

N64-31609 United Aircraft Corp., Sunnyvale, Calif. Research Labs.
MOMENTUM TRANSFER THROUGH THE ELECTRIC FIELDS
R. G. Meyerand, Jr. *In* AFOSR Advanced Propulsion Concepts, Vol. I 1963 p 177–197 refs (See N64-31601 23-27)

A self-consistent condition may exist in which a nonthermal electron energy distribution results in the existence of an electrostatic gradient in a plasma. The ion acceleration is obtained through momentum transfer from electron reflections in the space-charge neutral plasma. In a practical device, the electron momentum can be transferred through a magnetic mirror at the rear of the engine coupling the ion thrust to the engine structure in an efficient manner. In addition, the use of a purely radial magnetic field space-charge neutral ion accelerator gives promise of an alternate method for the production of high-current space-charge neutral ion beams. Author

N64-31613 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
GASEOUS CORE REACTORS
Robert V. Meghreblian and Henry J. Stumpf *In* AFOSR Advanced Propulsion Concepts, Vol. I 1963 p 293–339 (See N64-31601 23-27)

Concepts proposed are the vortex containment technique, in which the heat transfer is achieved by direct slowing down of the nuclear-fission fragments in the propellant gas, and the plasma core and coaxial flow reactor concepts, in which the fission fragments slow down in the fuel region, which then transfers its energy, principally by thermal radiation, to the propellant. Complex technical problems include fuel containment and radiation from the gases in the cavities. Low-acceleration missions to the near planets can be performed with gaseous fuel reactors at flight times substantially less than with electric systems. Low-acceleration missions to the far planets do not appear competitive with nuclear–electric systems unless the thermal radiation parameter can be reduced to 10^{-4} or less. R.L.K.

N64-31614 Aerojet-General Nucleonics, San Ramon, Calif. Research Div.
CONTROLLED FUSION PROPULSION
John S. Luce *In* AFOSR Advanced Propulsion Concepts, Vol. I 1963 p 343–380 refs (See N64-31601 23-27)

Areas are outlined in which research is needed before space fusion propulsion is feasible. Of the plasmas under consideration, ^{3}He-D is indicated because of the drastic reduction in neutron radiation. The confinement of a stable high-temperature plasma is the first milestone to be achieved; the straightforward high-energy injection of ^{3}He and D neutrals into the required strong magnetic field is the most logical method. There is strong evidence that collisions need not be the only source of ionized particles. High-energy excited neutrals are trapped by ionization due to the equivalent electric field acting on the high-velocity atom in the magnetic field. This is the basic injection and trapping system discussed. The advantage of a fusion reactor, besides the absence of radioactive products and neutrons, is the reduction in weight and complexity of the power-conversion systems, the thermal cycle and the radiator making possible an appreciably simpler vehicle. The direct conversion of power to thrust results in a very efficient, high-specific-impulse vehicle capable of handling large payloads. The specific impulse obtained from a 100 keV ^{3}He-D plasma is approximately 3×10^5 seconds. Variable thrust, which can be achieved by adding expellent, permits rapid transit through radiation belts as well as maneuverability in moderate gravitational fields. R.L.K.

N64-31615 Hughes Research Labs., Malibu, Calif.
FUSION PLASMA PROPULSION SYSTEM
William L. Linlor and Milton U. Clauser *In* AFOSR Advanced Propulsion Concepts, Vol. I p 381–407 refs (See N64-31601 23-27)

Recent developments important for fusion power in space propulsion are high magnetic-field superconductivity, lasers coupled with intense photon sources, and cryogenic pumping techniques. The present state of fusion research is evaluated, with emphasis on the problem of plasma stability. Two methods of fusion plasma production are described—electric-field dissociation and photodissociation. The conceptual design of a space propulsion system employing fusion power is sketched. Estimates are made of the performance and weight of such components as the reactor and thrust-augmenting unit. Also considered is the problem of disposal of heat represented by various radiations escaping from the plasma. R.L.K.

N64-31755 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THEORY, DESIGN, CALCULATION, AND TESTING OF INTERNAL COMBUSTION ENGINES
31 Jul. 1964 26 p refs Transl. into ENGLISH of selected articles from Tr. Inst. Dvigateley Akad. Nauk SSSR, no. 6, 1962 p 76–81, 110–117
(FTD-MT-64-03; AD-603400)

CONTENTS:

1. FLOW OF GAS IN THE CHANNEL OF AN AXIAL FRICTION TURBINE K. K. Sokolov p 1–8 refs (See N64-31756 23-02)

2. DEVELOPMENT OF FLAME AFTER IGNITION BY STABILIZED AND NONSTABILIZED ELECTRIC SPARK N. N. Zagryazkin and Yu. I. Timoshenko p 9–24 refs (See N64-31757 23-27)

N64-31757 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVELOPMENT OF FLAME AFTER IGNITION BY STABILIZED AND NONSTABILIZED ELECTRIC SPARK
N. N. Zagryazkin and Yu. I. Timoshenko *In its* Theory, Design, Calculation, and Testing of Internal Combust. Engines 31 Jul. 1964 p 9–24 refs (See N64-31755 23-27)

The influence of the spark and its energy on the development of the flame kernel in internal combustion engines was investigated by schlieren cinematography using a turbulent propane–air gas flow. The stability of the flame kernel was found to improve significantly with an increase in spark energy above the minimum energy required for ignition. The variation kernel development in a series of sparks in an automobile

ignition system appears to be related to the size of the gap in addition to spark energy. Stabilizing the spark improved the stability of flame kernel development by 12% to 18%. M.P.G.

N64-31887 Aerojet-General Corp., Sacramento, Calif. Sacramento Plant
MINIMUM FUEL- AND OXIDIZER-TANK ULLAGES, GEMINI LAUNCH VEHICLE
5 Jun. 1964 89 p
(Contract AF 04(695)-89)
(Rept.-0788-MU-1; AD-448603)

In the Gemini Propulsion Test Program, the use of reduced first- and second-stage fuel and oxidizer tank ullages was compared to Titan II engine-starting characteristics. Because no change was perceptible in suction pressure and other performance characteristics, the use of minimum tank ullages was not detrimental to engine operation. G.G.

N64-31904 Hiller Aircraft Corp., Palo Alto, Calif. Advanced Research Div.
INVESTIGATION OF MINIATURE VALVELESS PULSEJETS Summary Report, Jul. 1960–Jun. 1962
R. M. Lockwood and W. G. Patterson Ft. Eustis, Va., Army Transportation Res. Command, Feb. 1964 74 p refs
(Contract DA-44-177-TC-688)
(TRECOM-TR-64-20; AD-604028)

Eleven sizes and configurations of miniature valveless pulse jets were built and tested to determine performance and operational characteristics. When combined with ejector-type intermittent jet thrust augmenters, the best performance was achieved with the HH-M1 pulse jet with augmenters, which produced 17-lb thrust with a Tsfc of 1.8 and a thrust augmentation ratio of 1.9. Thrust-to-combustor volume ratio for this basic pulse jet was 140 lb/ft^3. With augmenters and enclosing shroud, the complete engine package would produce 20 lb/ft^3. Thrust-to-weight ratios approached 12 to 1 Author

N64-32030 Picatinny Arsenal, Dover, N.J.
DEVELOPMENT OF A ROCKET MOTOR FOR THE XM7 AIRCRAFT CAPSULE EJECTION CATAPULT
Gabriel C. Gratkowski Mar. 1964 53 p refs
(PA-TM-1224; AD-448472)

A novel side-thrust rocket motor was developed for ejecting an escape capsule from high-performance aircraft. A nitrocellulose-base propellant charge was developed to meet the ballistic performance requirements. The rate of rise of thrust was controlled during the ignition phase so that the capsule would not be subjected to more than 250 g/sec rate of change of acceleration. This was successfully accomplished by a special grain-inhibiting technique in which the exposed surfaces were incrementally inhibited by a dip method. Author

N64-32043 Sundstrand Aviation-Denver, Denver, Colo.
15-KW SOLAR MECHANICAL ENGINE Quarterly Progress Report No. 12, 1 Sep.–30 Nov. 1963
K. E. Nichols 15 Dec. 1963 100 p refs
(Contract AF 33(616)-7128)
(CDRD-63-5038; AD-447966)

The solar mechanical engine consists of the following components: energy collection subsystem; heat receiver; turboalternator assembly; radiator-condenser; orientation system; and controls. Activities in the following areas are summarized: (1) concentrator development—radiometer traversing mechanism and cold calorimeter; (2) heat receiver—small-scale and large-scale development; test equipment, metallurgical studies, gold coating tests, and polished inconel tests; (3) orientation system—system configuration studies, vehicle orientation (sun, earth, or nonoriented), rotating vehicle, disturbances and attitude-control torques, breadboard test-platform design, test-platform support bearings, test-platform configuration, orientation breadboard control system, error-angle development; and (4) tracking rig and cover—tracking-rig controls and mirror cover. P.V.E.

N64-32073 Canadian Armament Research and Development Establishment, Valcartier
23KS20000 BLACK BRANT ROCKET ENGINE OPERATION AND HANDLING INSTRUCTIONS
H. Rojeska comp. Aug. 1964 25 p */ts* Issue No. 1
(CARDE-TN-1629(64))

The manual contains 13 sections, 8 figures, and a revised and supplementary data-record section. The contents include a description of the specific engine, its purpose, its storage and shipping protection devices, inspection and installation of its igniter and nozzle assemblies, crating and transportation of the rocket engine itself and its igniter, temperature cycling of the rocket engine, and firing of the rocket engine. A.W.

N64-32121 Hughes Research Labs., Malibu, Calif.
ANALYTICAL AND EXPERIMENTAL STUDIES TO DEVELOP ION ENGINE GROUND TESTING TECHNIQUES Final Report, Jun. 1961–Mar. 1964
R. H. Hubach Arnold Eng. Develop. Center, Jun. 1964 69 p refs
(Contract AF 40(600)-948)
(AEDC-TDR-64-127; AD-445042)

Investigations of the interaction of an annular ion beam with its environment in ground test facilities have been performed to establish the conditions that best approximate the environment encountered in space. Techniques to investigate the degree of interaction and probes to infer specific parameters of the beam have been developed. Special emphasis has been placed on the neutralization problem. Author

N64-32243 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AIR INTAKE DEVICES OF SUPERSONIC AIRCRAFT
Yu. N. Nechayev 24 Aug. 1964 136 p refs Transl. into ENGLISH of the book "Vkhodnyye Ustroystva Sverkhzvukovykh Samoletov" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1963 p 1–140
(FTD-MT-64-301; AD-605246)

This book acquaints the reader with diagrams, principles of installation, and processes in air intake devices of supersonic aircraft. Basic attention is given to description of gasdynamic processes of intake with ferry diffusers, which have obtained wide propagation. Considered are conditions of work of intake supersonic diffusers of turbojet engines under different conditions of flight and operating conditions of powerplant. Possible failures and malfunctions are analyzed, and the physical processes occurring during unstable work of diffusers are described. Measures are expounded for preventing unstable work, including adjustment of diffusers. Author

N64-32288 Army Missile Command, Huntsville, Ala.
FIRING DEVELOPMENT STATIC TEST OF TX354 MOTOR NO. 1 (CASTOR II PROGRAM)
William B. Wahlheim [1964] 10 p
(RT-TN-64-37; AD-442886)

The Castor II Program is for the development and preflight rating tests of the improved TX354 (XM33E5) rocket

motor for use as the second stage of the improved Scout launch vehicles. The improvement of the XM33E5 is mainly in the form of incorporating an 89% total solids HC propellant in a modified configuration. The total propellant weight has increased approximately 1000 pounds with the new design. P.V.E.

N64-32302 Aerojet-General Corp., Sacramento, Calif. Sacramento Plant
WEAPONS SYSTEMS 133B; PRODUCTION OF WING VI MINUTEMAN SR 19-AJ-1 SECOND-STAGE MOTORS First Quarterly Report, Period Ending 31 Aug. 1964
R. D. Burleson 30 Sep. 1964 22 p
(Contract AF 04(694)-501)
(Rept.-0162-06QP-1; AD-448748)

Program milestones, the motor manufacturing and delivery schedule, and the procurement plan for major motor components are presented graphically. Engineering-change proposals submitted are summarized in a table. The status of documentation and specifications relating to various aspects of the program is given. The scheduled deliveries of factory support equipment and depot maintenance ground equipment are presented, and contract changes are listed.

N64-32387 British Internal Combustion Engine Research Assn., Slough (Gt. Brit.)
COMBUSTION IN DIESEL ENGINES
W. P. Mansfield 13 May 1964 3 p
(Contract DA-91-591-EUC-2974)
(QTSR-3; AD-447812)

The Gardner 1L2 engine has been rebuilt with a very low compression ratio (7.8:1) to extend existing results to lower compression temperatures. Tests using a small thermally insulated hot chamber as an igniter for the main chamber have been made on a National DSSAGP engine. Further tests were run on the Tangye VCP1 engine running with a low compression temperature obtained by means of the Atkinson cycle. Tests all confirm the relative insensitivity of this combustion system to long ignition delays in terms of rates of combustion pressure rise. A.W.

N64-32397 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS OF THE JET DRIVE OF A HELICOPTER ROTOR BY MEANS OF A TURBOJET ENGINE ATTACHED TO THE BLADES
B. P. Kaganovich 30 Mar. 1964 26 p Transl. into ENGLISH from the book "Silovyye Ustanovki Vertoletov" Moscow, Oborongiz, 1959 p 167–185
(FTD-MT-63-264; AD-602565)

This is a discussion of various conditions and features of a turbojet engine installed on a helicopter to drive the rotor, thus eliminating a heavy transmission and increasing the useful weight ratio. The main problems were found to be efficiency of bearings and heat dissipation from oil in large radial loads, and the balancing of the gyroscopic moment created by the rotor revolving, together with the rotor blade. G.G.

N64-32455 Thiokol Chemical Corp., Huntsville, Ala. Huntsville Div.
INSPECTION SERVICES AND ENGINEERING EVALUATION OF AGED M30 ROCKET MOTORS Final Report
Robert T. Davis 5 Jun. 1964 28 p refs
(Contract DA-01-021-ORD-11919)
(Rept.-19-64; AD-449214)

In 1957, M30 motors were placed in storage in Panama, Canada, and Arizona. After several years, the surface of the propellant in the aged motors appeared to contain many cracks. An inspection and engineering evaluation were conducted of some of these motors to determine if they were of flight quality. In general, except for an increase in the ignition delay time, the aged motors functioned satisfactorily. The cracks were superficial crust cracks with no measurable width or depth. A new Pyrogen igniter was developed to correct the ignition delay problem. Author

N64-32465 Curtiss-Wright Corp., Wood-Ridge, N.J. Wright Aeronautical Div.
SUPERSONIC TRANSPORT PROPULSION SYSTEM CONTINUED RESEARCH AND STUDY OF HIGH TEMPERATURE TURBINE AND EXHAUST NOZZLE NOISE. VOLUME II: EXHAUST NOZZLE NOISE PROGRAM Quarterly Progress Report, 15 Jan.–15 Apr. 1964
15 May 1964 41 p refs
(Contract AF 33(657)-9058)
(QPR-4; AD-448762)

The exhaust nozzle noise research and study program is directed toward the development of an efficient low-noise-level exhaust system for installation on the propulsion system of the supersonic transport aircraft. The principal accomplishments discussed include the completion of all noise and thrust testing and the reduction and analysis of data from testing conducted on both the existing convergent plug-type nozzle model modified with new concepts for noise suppression and the new convergent–divergent plug-type nozzle model. Author

N64-32596 Frankford Arsenal, Philadelphia, Pa.
PROPELLANT ACTUATED DEVICES Progress Report, Mar.–Apr. 1964
[1964] 90 p refs

The following topics in regard to propellant actuated devices are discussed: design and development of thrusters, ejectors, catapults, and initiators; investigation of propellants and structural materials; feasibility studies for performance improvement and application of propellant activated devices, parachute employment, and liferaft inflation in an escape system. G.G.

N64-32614 Donaldson Co., Inc., Minneapolis, Minn.
DUST CONCENTRATION MEASUREMENT ON THE U.S. ARMY OVERLAND TRAIN MARK II Final Report
Mark G. Mund Ft. Eustis, Va., Army Transportation Res. Command, Apr. 1964 50 p refs
(Contract DA-44-177-AMC-24(T))
(TRECOM-TR-64-16; AD-604027)

Based on test results from the model air cleaners, the main engine STRATA-Panel air cleaners reduce the dust concentration from an average ambient concentration of 4.7 mg/ft^3 to an average passing concentration of 0.73 mg/ft^3. The dust passing the air cleaners is essentially the same size as the dust entering the air cleaner, measured as discrete particles, and this is true only because the dust is fine and agglomerated. If a practical method were available to measure effective particle size, the dust passing the air cleaner would be finer than the dust entering the air cleaner. Based on previous Overland Train experience on short turbine life caused

by dust ingestion, the STRATA-Panel gas turbine air cleaners installed on the Overland Train will extend the life of the gas turbines. Author

N64-32676 Lincoln Lab., Mass. Inst. of Tech., Lexington
DESIGN, DEVELOPMENT, QUALIFICATION, AND DELIVERY OF 15-IN. DIAM. SPHERICAL ROCKET MOTOR Monthly Progress Report, 1–30 Sep. 1963
C. E. Young 3 Oct. 1963 8 p
(Contract AF 19(628)-500; ARPA Order 13)
(MPR-17; AD-449762)

This article covers spin testing of several 15-in.-diameter spherical rocket motors, to be used with a high-energy polyurethane propellant for improved performance, produced under revised mixing and casting processes. The voids and separations found were repaired and radiographically reinspected. It was found that the changes reduced the number and size of propellant voids. G.G.

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-31447* National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENTS OF THE MAGNITUDE AND DIRECTION OF THE MAGNETIC FIELD IN THE REGION OF SUNSPOTS [IZMERENIYA VELICHINY I NAPRAVLENIYA MAGNITNOGO POLYA V OBLASTI SOLNECHNYKH PYATEN]
B. A. Ioshpa and V. N. Obridko Mar. 1964 5 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 40, no. 6, 1963 p 1013–1015
(NASA-TT-F-8850) OTS: $1.00 fs; $0.50 mf

A total vector magnetograph method developed for simultaneously measuring all the quantities that determine the magnitude and direction of the magnetic field on the solar surface is described. The method is based on the measurement of the Stokes parameters of the incident radiation. In the proposed method, only one scan over the solar surface is necessary to determine all the parameters of the magnetic field simultaneously. P.V.E.

N64-31560* Consultants and Designers, Inc., Arlington, Va.
SOME ELEMENTS OF THEORY OF GEOMAGNETIC STORMS [NEKOTORYYE ELEMENTY TEORII GEOMAGNITNYKH BURI]
V. I. Afanas'yeva, Yu. D. Kalinin, and E. I. Mogilevskiy 5 Oct. 1964 18 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 4, 1964 p 722–731
(Contract NAS5-3760)
(NASA-TT-F-8967; ST-GM-10216) OTS: $1.00 fs; $0.50 mf

This paper considers the ideas indicating that solar corpuscular streams consist of plasma clusters with a force-free magnetic field. It is shown that 5.5 hours after Mariner-2 registered a magnetic disturbance, a worldwide disturbance of the same form was registered at the ground. Conclusions were derived that inductance and resistance to the electric current of the magnetosphere have to be taken into account when attempting to explain the irregular part of the magnetic storms. Author

N64-31570* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CERENKOV SCINTILLATION COUNTER MEASUREMENTS OF THE INTENSITY AND MODULATION OF LOW RIGIDITY COSMIC RAYS AND FEATURES OF THE GEOMAGNETIC CUTOFF RIGIDITY
W. R. Webber (Minnesota U.) and F. B. Mc Donald repr. from J. Geophys. res., v. 69, no. 15, 1 Aug. 1964 p 3097–3114 refs
(NASA-RP-309)

The primary cosmic radiation has been measured with a Cerenkov scintillation counter at various times in the solar cycle at locations having nominal cutoff rigidities of 0.8, 1.6, and 2.7 bV. Results are used here to delineate spectral features of low rigidity protons and α particles and to examine the rigidity and charge dependence of the 11-year solar modulation. Details of particle transmission near the geomagnetic cutoff are also examined. The measurements indicate the following: (1) The observed nonsharp cutoff appears to be primarily due to expected transmission effects in a dipole-like field and to instrumental effects, and the actual cutoff is quasi-sharp in the Stomer sense. (2) The rigidity dependence of the 11-year modulation of protons and that of α particles are closely similar above $\approx$ 1.2 bV. (3) The differential spectrum of galactic cosmic rays near sunspot minimum at about 1-bV rigidity is either flat or falling slightly toward lower rigidities. Author

N64-31590 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSACTIONS OF THE CENTRAL AEROLOGICAL OBSERVATORY
3 Jun. 1963 73 p refs Transl. into ENGLISH of selected articles from Tr. Tsentr. Aerol. Observ. (Leningrad), no. 32, 1961 p 46–87
(FTD-TT-62-1511/1+2; AD-414718)

The following topics are discussed: (1) certain errors in the determination of the absorption of solar radiation in the atmosphere, using pyranometers; (2) certain features of radiation processes in the lower troposphere of the Antarctic; (3) absorption of solar radiation in the lower troposphere; and (4) the asymmetry of light scattering in the atmosphere. M.P.G.

N64-31720* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF LOW-ENERGY GALACTIC COSMIC-RAY HYDROGEN AND HELIUM
C. E. Fichtel, D. E. Guss, D. A. Kniffen, and K. A. Neelakantan Repr. from J. Geophys. Res., v. 69, no. 15, 1 Aug. 1964 p 3293–3295 refs
(NASA-RP-336)

The results of the nuclear emulsion studies of the hydrogen and helium nuclei obtained in 1962 and 1963 from balloon flights from Fort Churchill, Canada, are presented and compared to those obtained in 1961. These results suggest strongly that there is a splitting below a rigidity of about 1.3 BeV/c between the proton differential spectrum and that for helium nuclei multiplied by seven. D.E.W.

N64-31721* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
EMISSION OF EXTREME ULTRAVIOLET RADIATION FROM SOLAR CENTERS OF ACTIVITY

W. M. Neupert Repr. from Space Res. IV, Proc. of the 4th Intern. Space Sci. Symp., Warsaw, v. 3, 4–10 Jun. 1963 p 730–740 refs
(NASA-RP-345)

Line emissions at 284 Å, 304 Å, and 335 Å in the solar extreme-ultraviolet spectrum observed by OSO-1 have been compared with 2800-Mc emission and other indicators of solar activity. Increase in these ultraviolet fluxes can be localized to active regions on the solar disk. Changes in the intensities of the lines are discussed in terms of changes in electron temperature and electron density of the active regions. Certain assumptions made in the calculation of a coronal electron temperature from the relative populations in two stages of ionization of an element are examined, with the conclusion that this calculation may not be valid for the particular case of the solar corona, yielding a fictitiously low value if there is an outward expansion of ions from the base of the corona into a region of higher electron temperature. A nonequilibrium formulation for the distribution of ions is presented that may better describe the actual ion distribution in the corona. An approximate calculation shows that an average radial velocity outward, and small compared with the average thermal velocity of the ions, is sufficient to explain the observed increase in height of the maxima of emission of the Fe ion sequence with increasing stage of ionization in the undisturbed corona. Author

N64-31722* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR X-RAYS: SLOW VARIATIONS AND TRANSIENT EVENTS
W. A. White Repr. from Space Res. IV, Proc. of the 4th Intern. Space Sci. Symp., Warsaw, v. 7, 4–10 Jun. 1963 p 771–779 refs
(NASA-RP-346)

Discussed are observations of the solar X-ray flux integrated over the interval 0.1-10 Å, made by the OSO-1 satellite in early 1962 using a xenon-filled ion chamber with a thin beryllium window. A slowly varying component is found in the solar X-ray flux below 11 Å that correlates with the slowly varying component of the 2800-Mc solar radiation. This quasi-stable component is accounted for by localized sources having the same horizontal extent as the Ca plages with thicknesses proportional to their diameter and having an electron temperature of about 2.8×10^6 ° K and an electron density of about 5×10^9 electrons per cm^3. It is also concluded that for these conditions the ratio of line emission to continuum emission is at least 10:1 and more probably 30:1. In addition to the slowly varying component, transient events (X-ray flares) lasting from 10 minutes to a few hours are reported. IAA

N64-31754 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON CENTRAL INTENSITIES OF STRONG FRAUNHOFER LINES OF THE SPECTRUM OF THE SUN
D. M. Kuliyev *In its* Herald of the Leningrad U. 28 Jul. 1964 p 187–195 refs (See N64-31742 23-23)

Residual central intensities of some strong Fraunhofer lines in the spectrum of the center and in the limb of the sun are measured. It is shown that the Melnikov relation takes place in case of strong lines as well. It is assumed that the large observational values for the strong lines are partly raised by the disturbance of chromospheric radiation in line frequencies. A.W.

N64-31843 American Science and Engineering, Inc., Cambridge, Mass.
A RESEARCH PROGRAM TO INVESTIGATE THE CHARGED PARTICLE FLUX IN THE NEAR-EARTH MAGNETOSPHERE FROM A P-11 SUB-SATELLITE Final Report
F. R. Paolini, R. Giacconi, J. R. Waters, and T. G. Quinn, Jr. 27 May 1964 262 p refs
(Contract AF 19(628)-2392)
(ASE-546; AFCRL-64-435; AD-603790)
CONTENTS:

1. A RESEARCH PROGRAM TO INVESTIGATE THE CHANGED PARTICLE FLUX IN THE NEAR-EARTH MAGNETOSPHERE FROM A P-11 SUB-SATELLITE F. R. Paolini, R. Giacconi, J. R. Waters, and T. G. Quinn, Jr. 206 p refs (See N64-31844 23-28)
2. MEASUREMENTS IN THE RADIATION BELTS FROM HITCH-HIKER I F. R. Paolini, R. Giacconi, J. R. Waters, L. Katz, and D. Smart 39 p refs (See N64-31845 23-28)

N64-31844 American Science and Engineering, Inc., Cambridge, Mass
A RESEARCH PROGRAM TO INVESTIGATE THE CHARGED PARTICLE FLUX IN THE NEAR-EARTH MAGNETOSPHERE FROM A P-11 SUB-SATELLITE
F. R. Paolini, R. Giacconi, J. R. Waters, and T. G. Quinn, Jr. *In its* A Res. Program to Investigate the Charged Particle Flux in the Near-Earth Magnetosphere from a P-11 Sub-Satellite 27 May 1964 206 p refs (See N64-31843 23-28)

Above 0.5 MeV, the integral electron spectra decreased monotonically with energy, but the spectra obtained in the inner belt and "slot" were much flatter than those obtained in the outer belt. Between 10 and 100 keV, maxima in the differential spectra around 40 keV were observed in some regions of the inner belt. In this energy region the energy-integrated intensity tended to decrease with increasing L beyond 1.6—i.e., there was no distinct "slot." Between 18 and 60 MeV, in the inner belt around $L \approx 1.6$, proton integral spectra fit an $E^{-\gamma}$ law with $\gamma \approx 5.4$; between 1 and 4 MeV, the spectra monotonically decreased with energy but fit no simple law. There was some evidence of a slot in the belt structure at these energies. Geiger counter and electron spectrometer rate of energy deposition data illustrated belt profiles as expected, with distinct inner and outer zones and with a well-defined slot between them. Author

N64-31845 American Science and Engineering, Inc., Cambridge, Mass
MEASUREMENTS IN THE RADIATION BELTS FROM HITCH-HIKER I
Frank Paolini, Riccardo Giacconi, John R. Waters, Ludwig Katz, and Don Smart (AFCRL) *In its* A Res. Program to Investigate the Charged Particle Flux in the Near-Earth Magnetosphere from a P-11 Sub-Satellite 27 May 1964 39 p refs Presented at the 5th Intern. Space Sci. Symp., Florence, 12–16 May 1964 (See N64-31843 23-28)
(ASE-604)

The satellite carried a payload that included six radiation-detection instruments for simultaneously investigating the energy spectra and angular distributions of protons and electrons in the earth's magnetosphere over a broad range of energies. Data show qualitative differences in the structures of the radiation belts defined by the different energy bands investigated. Author

N64-32057 National Academy of Sciences-National Research Council, Washington, D.C. Prevention of Deterioration Center
EFFECTS OF VAN ALLEN RADIATION BELTS ON ELECTRONIC MATERIALS An Introductory Bibliography
Richard W. H. Lee, comp. 18 Jan. 1963 5 p refs
(PDC-Search-63-003; PDL-46195; AD-601298) OTS: $1.00

N64-32077* Yale U. Observatory, New Haven, Conn.
EXCITATION OF LUNAR LUMINESCENCE BY SOLAR PROTONS
S. P. S. Anand, L. Oster, and S. Sofia Repr. from Nature (London), v. 202, no. 4937, 13 Jun. 1964 p 1097–1098 refs
(Grant NsG-176)

Bombarding a stony meteorite (achondritic enstatite) by a proton beam of 40 keV has been shown to cause a strong luminescence of the material over a broad range of wavelengths near 6700 A. Based on this observation it is suggested that the red glows observed on the night of November 1–2, 1963 in the Kepler region of the moon might be due to the bombarding of the crater by fast protons from the sun. The observed events on the moon can be related to a large number of possible flares on the sun, with time delays ranging from a few hours to several days. From this it is concluded that a decision as to the energy of the protons striking the lunar surface can be made only when a statistically significant number of events on the moon is observed. P.V.E.

N64-32078 Sacramento Peak Observatory, Sunspot, N.Mex.
THE MOTION OF CA + IN THE CHROMOSPHERE AND THE CONNECTION OF MOTION WITH MAGNETIC FIELDS
V. E. Stepanov [1960] 22 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), 23, 1960 p 184–211 *Its* Solar Res. Note 44
(AD-420769)

The magnetograph and recorder of radial velocities were used for measuring the longitudinal magnetic field in line Fe λ 5250 Å and radial velocities and brightness in H_3 Ca^+. The radial velocity field above active solar regions in flocculi and in undisturbed chromospheric regions was investigated. The radial velocities were compared with the magnetic field distribution at the photospheric level. It was established that in the chromosphere there are extensive regions, with ascending and descending gas, which extend up to 200 000 km. The motion in these regions has the character of large-scale turbulence. The characteristic scale of the elements is 5000 to 20000 km and the lifetime is ~ 7 hours. The total mean velocity of turbulent elements is 3.6 km/sec. In the undisturbed chromosphere the mean velocity of the ascending gas is −0.96 km/sec, and the descending +1.25 km/sec. Author

N64-32469 Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences
MAGNETO-ATMOSPHERIC WAVES IN A HORIZONTALLY STRATIFIED CONDUCTING MEDIUM
C. P. Yu Jun. 1964 87 p refs
(Grant NsF GP-927)
(A&ES-64-8)

The classical problem of atmospheric waves in an isothermal medium has been extended to the case of an electrically conducting fluid in the presence of a horizontal magnetic field that varies with height. It was found that convective instability arises when the ratio of the Alfvén speed to the sound speed exceeds $\sqrt{2(1-1/\gamma)}$, where γ is the adiabatic index. When the stability criterion is satisfied, a disturbance in the medium will travel as waves in three different modes. For small wave numbers, two of these modes are similar to the acoustic and gravity modes found in the nonmagnetic case. For very large wave numbers, the acoustic mode becomes the modified sound wave found in the case of a uniform medium, while the gravity wave behaves as the corresponding modified hydromagnetic wave. The third mode behaves nearly as a hydromagnetic wave; it is influenced only to a minor extent by compressibility and gravity. P.V.E.

N64-32629 Air Force Cambridge Research Labs., Bedford, Mass.
RADIO STAR SCINTILLATION OVER CANADA DURING THE 20 JULY 1963 ECLIPSE Environmental Research Papers No. 40
R. S. Allen, J. A. Klobuchar, W. C. Kidd, and H. E. Whitney Aug. 1964 23 p refs
(AFCRL-64-662; AD-606551)

Amplitude scintillations of the radio energy from the galactic radio source Cassiopeia A were examined for the total solar eclipse of July 20, 1963, using a 150-ft parabolic antenna. The extent of eclipsing varied along the ionospheric ray path from 100% at about 100 km to about 80% near 500 km. Chart recordings of the amplitude variations of the Cassiopeia A signal were made at frequencies of 29.8, 63, 113, and 228 Mc/sec. The extent of variation in amplitude and rate of scintillation was comparable to the extent on control days. Examination of the frequency dependence showed that the scale size of the irregularities did not change significantly during the eclipse period. No effects in the scintillation records could be uniquely related to the reduction of ionizing illumination and subsequent cooling of the medium. Author

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-31449* National Aeronautics and Space Administration, Washington, D.C.
THE PRINCIPLE STRUCTURAL ELEMENTS OF THE MOON [GLAVNEYSHIYE STRUKTURNYYE ELEMENTY LUNY]
Yu. A. Khodak Feb. 1964 15 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 3, Nov.–Dec. 1963 p 465–471
(NASA-TT-F-8835) OTS: $1.00 fs, $0.50 mf

The characteristics of the principal structural elements of the visible and far sides of the moon are described. It is noted that the lunar crust is divided into large blocks by a series of deep fault zones running in four directions. Author

N64-31522 Air Force Systems Command, Wright-Patterson AFB Ohio Foreign Technology Div.
COSMIC RESEARCH, VOLUME 2, NUMBER 3, 1964
28 Jul. 1964 242 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 2, no. 3, 1964 p 355–504
(FTD-TT-770/1+2; AD-603012)

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2. INTERPLANETARY FLIGHTS WITH CONSTANT OUTPUT ENGINES V. V. Beletskiy and V. A. Yegorov p 8–55 refs (See N64-31524 23-32)

3. THE ACCELERATION OF A SPACECRAFT WITHIN THE RANGE OF PLANETARY INFLUENCE V. V. Beletskiy and V. A. Yegorov p 56–81 refs (See N64-31525 23-30)

4. ON SPACE-FLIGHT TRAJECTORIES WITH A CONSTANT-REACTION ACCELERATION VECTOR V. V. Beletskiy p 82–90 ref (See N64-31526 23-29)

5. OPTIMUM TRAJECTORIES AND OPTIMUM PARAMETERS FOR SPACE VEHICLES WITH ENGINES OF LIMITED OUTPUT Yu. N. Ivanov, V. V. Tokarev, and Yu. V. Shalayev p 91–118 refs (See N64-31527 23-30)

6. METHOD OF QUICKEST DESCENT AS APPLIED TO COMPUTATION OF INTERORBITAL TRAJECTORIES WITH ENGINES OF LIMITED POWER Yu. N. Ivanov and Yu. V. Shalayev p 119–129 refs (See N64-31528 23-29)

7. RADIATIVE HEATING IN HYPERSONIC FLOW L. M. Biberman, V. S. Vorob'yev, G. E. Norman, and I. T. Yakubov p 130–156 refs (See N64-31529 23-13)

8. OPTICAL PROPERTIES OF CLOUDS Ye. M. Feygel'son p 157–168 refs (See N64-31530 23-23)

9. EQUATION FOR RELEVANCE OF INFORMATION FROM WEATHER SATELLITES AND FORMULATION OF INVERSE PROBLEMS G. I. Marchuk p 169–192 refs (See N64-31531 23-23)

10. ANALYTICAL REPRESENTATION OF THE EARTH'S MAGNETIC FIELD IN THE ORBITAL COORDINATE SYSTEM A. D. Shevnin p 193–202 refs (See N64-31532 23-12)

11. GEOGRAPHICAL DISTRIBUTION OF RADIATION INTENSITY IN THE REGION OF THE BRAZILIAN MAGNETIC ANOMALY AT AN ALTITUDE OF ABOUT 300 km S. N. Vernov, V. Ye. Westerov, I. A. Savenko, P. I. Shavrin, and K. N. Sharvina p 203–213 refs (See N64-31533 23-12)

12. INVESTIGATION OF TERRESTRIAL RADIATION BELTS IN THE VICINITY OF THE BRAZILIAN MAGNETIC ANOMALY AT ALTITUDES OF 235–345 km S. N. Vernov, V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, O. I. Savun et al p 214–223 refs (See N64-31534 23-12)

13. THE POSSIBILITIES OF REPLACING THE NITROGEN IN THE AIR WITH HELIUM IN SPACE-VEHICLE CABINS AND THE EFFECTIVENESS OF USING A HELIUM-OXYGEN MIXTURE FOR VENTILATION OF A SPACE-PRESSURE SUIT A. G. Dianov p 224–236 refs (See N64-31535 23-16)

N64-31526 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON SPACE-FLIGHT TRAJECTORIES WITH A CONSTANT-REACTION ACCELERATION VECTOR

V. V. Beletskiy *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 82–90 ref (See N64-31522 23-29)

The equations of motion of a space vehicle in a Newtonian force field are investigated for a constant-reaction acceleration vector. Two-dimensional trajectories are classified. Author

N64-31528 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METHOD OF QUICKEST DESCENT AS APPLIED TO COMPUTATION OF INTERORBITAL TRAJECTORIES WITH ENGINES OF LIMITED POWER

Yu. N. Ivanov and Yu. V. Shalayev *In its* Cosmic Res. Vol. 2, No. 3, 1964 28 Jul. 1964 p 119–129 refs (See N64-31522 23-29)

In the variational problem of space-vehicle flights using an engine of limited power between coplanar circular orbits in a central gravitational field, two solution methods are considered—the Ritz method with the coefficients determined by the quickest-descent method and the method of functional quickest descent. The results of calculations are presented, and the efficiencies of solving the problem by the two methods are compared. Author

N64-31592 New Mexico U., Albuquerque Research Center

PLANETARY AND LUNAR RESEARCH IN THE PHOTOGRAPHIC INFRARED, VISIBLE AND ULTRAVIOLET Semi-Annual Report, 1 Oct. 1963–31 Mar. 1964

Clyde W. Tombaugh May 1964 7 p refs

(Grant DA-ARO(D)-31-124-G41)

(SAR-6; AD-604356)

Observations made of Venus, Jupiter, and the Moon are summarized. Reduction work on Venus plates involved the optically thin scattering layer in the Cytherean atmosphere, and progress was made on a photographic atlas. Reduction of plates obtained during the 1963 Mars apparition was begun. Compilation of a provisional topographic map of Mars was continued. Work was in progress to determine whether the terrain relief was accomplished in the Martian geologic past ages by faulting or monocline folding. Reduction of Jovian data continued with considerable activity observed in and around the Red Spot. Instrumentation developments involved completion of a grating spectrograph, so designed that the spectrum may be recorded either photographically or photoelectrically; design work on a new photoelectric system suitable for liquid nitrogen refrigeration; an electronically timed and driven shutter mechanism; a special mechanism for the Newtonian focus of the 12-in. Fecker telescope to facilitate time exposures of rapidly moving objects, and design of slewing drives in declination and hour angle for the 16-in. Gregorian reflector. R.L.K.

N64-31616 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

FEASIBILITY OF INTERSTELLAR TRAVEL

Dwain F. Spencer and Leonard D. Jaffe *In* AFOSR Advanced Propulsion Concepts, Vol. 1 1963 p 409–432 refs (See N64-31601 23-27)

Previous studies of interstellar travel concluded that using either fission- or fusion-nuclear reaction as an energy source was impossible because of fundamental limitations on the amount of available energy. This analysis shows that nuclear fission or fusion rockets can theoretically perform interstellar missions with reasonable flight times. Basic equations for single-stage and multistage rockets are determined and used to obtain examples of velocities and transit times. Some of the requirements of a fusion-propelled vehicle to perform an interstellar probe mission are considered. The magnitude of the associated engineering problems is indicated. R.L.K.

N64-31723* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

RANGER VII PHOTOGRAPHS OF THE MOON. PART I: CAMERA "A" SERIES

Gerard P. Kuiper et al Washington, NASA, Sep. 1964 226 p refs Sponsored by NASA

(NASA-SP-61) GPO: $6.50

The Ranger VII mission and trajectory are described. Impact-area selection and camera terminal alignment are discussed. The television system is described, and a table of values

for camera *A* is given. The table includes for each photograph the Gmt, the moon-centered coordinates, photograph data, scale, and angular deviation north. A series of 199 photographs is presented that was taken by camera *A* in Ranger VII and telemetered to earth from lunar altitudes between 2096 km and impact. D.E.W.

N64-31774 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FLIGHTS INTO SPACE
Yu. N. Sushkov 22 Jun. 1964 149 p refs Transl. into ENGLISH of "Polety v Kosmos" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1963 p 1–138
(FTD-MT-64-227; AD-605244)

Outstanding flights of Soviet astronauts are described, and technical aspects of manned distant space flight are discussed. Emphasis is placed on "Gravity"; "Carrier Rocket"; "Interplanetary Flights"; "Astronaut Ship"; "Man in Space Flight"; and "Safety of Flight." This is followed by some data from the cosmic apparatus "Polet-1." G.G.

N64-31966 Mitre Corp., Bedford, Mass.
A METHOD OF COMPUTING SATELLITE POSITION IN LOW-INCLINATION, LOW-ECCENTRICITY ORBITS AROUND AN OBLATE EARTH
R. H. Greene Jul. 1964 32 p refs
(Contract AF 33(600)-39852)
(ESD-TDR-63-443; TM-3500; AD-604864)

This document presents a method for computing the position of a satellite in a low-inclination, low-eccentricity orbit around an oblate earth using a set of orbital elements developed by S. Herrick. Previous investigations using these orbital elements have not included the perturbations caused by the oblateness of the earth. The entire procedure has been programed for a digital computer, and the results checked with other methods that make use of different orbital parameters. A relatively small amount of computer time is required. Author

N64-31972 RAND Corp., Santa Monica, Calif.
SHAPE AND INTERNAL STRUCTURE OF THE MOON
Donald L. Lamar and Jeannine Mc Gann Sep. 1964 36 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3964-PR; AD-606027)

Studies of the libration of points on the moon's surface and the occultation of stars on the limb reveal a 10-km range in heights on the moon's surface. These data and the 1-km separation of the center of mass from the center of the moon's disk indicate that the continental areas are approximately 3 km higher than the maria. The values of the differences in the moon's principal moments of inertia require that there be a concentration of material in the equatorial regions and around the axis pointing toward the earth. If continental areas were so concentrated, the density distribution within the moon could be spherically symmetrical. Utilizing charts prepared from Russian photographs of a portion of the moon's far side, it is shown that the actual continental-maria distribution is opposite to that required to explain the moment-of-inertia data. This discrepancy between the differences in moments of inertia and the gross shape, as reflected in the distribution of continents, indicates that density variations exist within the moon. Author

N64-32101 Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.
BIBLIOGRAPHY OF EXTRA TERRESTRIAL RESEARCH
Robert W. Henny Jul. 1964 217 p refs 2d ed.
(AFWL-TDR-64-29; AD-604105)

N64-32156 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Astro and Geophysics Section
PARTICLES AND RADIATION IN THE MARTIAN ATMOSPHERE
T. Fink and N. Milford Sep. 1963 21 p refs
(RM-222; AD-421540)

When galactic cosmic rays and high-energy solar particles impinge on the atmosphere of Mars, the primary particles, secondary particles, and radiation penetrate to various levels of the atmosphere. The approximate intensities of protons, electrons, neutrons, and muons at several levels in the Martian atmosphere are calculated. The corresponding radiation dosages are derived. It is found that the probable radiation dosages at the surface of Mars are about as large as the tolerable human dosage. Author

N64-32381* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METEORIC FLUX AND DENSITY FIELDS ABOUT A FINITE ATTRACTIVE CENTER GENERATED BY A STREAM MONOENERGETIC AND MONODIRECTIONAL AT INFINITY
D. P. Hale and J. J. Wright repr. from j. Geophys. res., v. 69, no. 17, 1 Sep. 1964 p 3719–3726 refs
(NASA-RP-327)

Detailed meteoric flux and particle density and field patterns generated by a meteoric stream, monodirectional and mono-energetic at infinity, and incident upon a finite attractive center, are derived and exhibited. Flux and density contours are obtained for a series of incident speeds spanning the entire range of established meteoric stream velocities. The development reveals the existence of five sectors about the attractive center. In some, flux is unscattered; in others, the flux is scattered; in one, the flux is both unscattered and scattered; in another, the null cone, there is no flux. All sectors including the null cone are treated in detail. An explicit theoretical explanation of abrupt discontinuities in flux and enhanced particulate concentrations near the earth, both of which are observed in rocket and satellite experiments, is given. Author

N64-32382* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METEORIC FLUX AND DENSITY FIELDS ABOUT AN INFINITESIMAL ATTRACTIVE CENTER GENERATED BY A STREAM MONOENERGETIC AND MONODIRECTIONAL AT INFINITY
D. P. Hale and J. J. Wright Repr. from J. Geophys. Res., v. 69, no. 17, Sep. 1964 p 3709–3717 refs
(NASA-RP-329)

The meteoric field structure theory previously developed for meteoric streams monoenergetic and monodirectional at infinity is applied to the problem of a meteoric stream incident upon an infinitesimal attractive center. Flux and density contours about the center are explicitly obtained for a particle speed at infinity of 2 km/sec as an example of a method developed to provide flux and density contours for any speed. An incident stream 5 to 10 earth diameters in width results in an order of magnitude enhancement of flux at points down stream from the attractive center. The flux patterns for any

energy can be derived from a universal flux plot in terms of a dimensionless parameter $\lambda = yr$, where $y = V\infty^2/\gamma M$, and r is distance in earth (or center) radii. This universal flux plot is shown. Author

N64-32401* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SIMPLIFIED TECHNIQUE FOR DETERMINING DEVIATION IN THE LUNAR TRANSFER ORBIT EMPHEMERIS
Richard Reid Washington, NASA, Oct. 1964 21 p refs
(NASA-TN-D-1837) OTS: $0.50

A linear algebraic equation was derived to determine the altitude deviation of a transfer orbit at selected anomaly angles as a function of errors in the magnitude and direction of the transfer maneuver. The technique is applied to both synchronous orbit and Hohmann transfer maneuvers of the lunar excursion module from the Apollo vehicle in a circular lunar orbit. The technique requires the pilot to make two altitude measurements with known included angles after the orbit transfer maneuver. With precomputed constants, the altitude deviation at any future anomaly angle may then be computed. Author

N64-32492* Georgetown U., Washington, D.C.
SPECTROSCOPIC STUDY OF SOLAR AND PLANETARY ATMOSPHERES Semi-Annual Status Report No. 2, 1 Aug. 1963–1 Feb. 1964
Francis J. Heyden [1964] 15 p
(Grant NsG-362)
(NASA-CR-59060) OTS: $1.00 fs; $0.50 mf

The method of observation was refined, and data were analyzed. Areas of research comprise the preparation of the simulated Martian atmosphere, the study of the spectrum of Jupiter from high dispersion plates taken on the Georgetown spectrograph, and the observation of planets at every available opportunity, along with spectrum analysis. Spectrographs are included for Mars, the Moon, nitrogen dioxide absorption, and the Sun. D.E.W.

N64-32637* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PARAMETRIC PERFORMANCE ANALYSIS FOR INTERPLANETARY MISSIONS UTILIZING FIRST-GENERATION NUCLEAR STAGES
Walter H. Stafford, Sam H. Harlin, and Carmen R. Catalfamo Washington, NASA, Oct. 1964 211 p refs
(NASA-TN-D-2160) OTS: $3.50

The effect of earth thrust-to-weight ratios and specific impulses on trajectory parameters has been investigated for hyperbolic escape from, and braking into, an orbit about each of the planets Mars and Venus, and also for escape from Earth. For the escape trajectories, the thrust vector was applied tangential to the flight path and in the direction of the velocity vector. For the braking-in trajectories, the thrust vector was directed against the velocity vector. Specific impulses of 600 to 1000 seconds and thrust-to-weight ratios of 0.05 to 0.5 were used. The range of parameters considered is thought to be the most practical for interplanetary missions utilizing first-generation nuclear stages. The results of the study are presented graphically. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-31525 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE ACCELERATION OF A SPACECRAFT WITHIN THE RANGE OF PLANETARY INFLUENCE
V. V. Beletskiy and V. A. Yegorov *In its* Cosmic Res., Vol. 2, No. 3 1964 28 Jul. 1964 p 56–81 refs (See N64-31522 23-29)

An investigation is presented of the space acceleration trajectories within the range of planetary influence in the case of low-reaction-thrust acceleration. An approximate solution is presented for the problem pertaining to the optimum control of reaction-thrust acceleration. Formulas are presented for the computation of trajectory parameters at the end of the acceleration phase. Calculation results for a number of trajectories are presented. Author

N64-31527 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OPTIMUM TRAJECTORIES AND OPTIMUM PARAMETERS FOR SPACE VEHICLES WITH ENGINES OF LIMITED OUTPUT
Yu. N. Ivanov, V. V. Tokarev, and Yu. V. Shalayev *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 91–118 refs (See N64-31522 23-29)

Discussed is the two-dimensional problem of flight of a space vehicle from the earth's sphere of influence to the sphere of influence of another planet and back. The trajectories of motion and vehicle parameters corresponding to maximum payload at the end of the flight are derived for space vehicles with engines of limited power. Author

N64-32070 Sandia Corp., Albuquerque, N. Mex.
RE-ENTRY FLIGHT DEMONSTRATION NUMBER ONE (RFD-1), DATA BOOK
C. E. Erickson Sep. 1964 113 p
(SC-RR-64-502) OTS: $2.50

This volume contains the uninterpreted or raw data from the instrumentation employed. Included are radar plots, photographs obtained by various optical instruments, and the data transmitted by telemetry up to the time of rf blackout. No post-blackout data are available, since no information was received from the telemetry system after the beginning of blackout. Author

N64-32192 Boeing Co., Seattle, Wash.
DERIVATION OF ROTATING FLEXIBLE BODY LINEARIZED EQUATIONS OF MOTION
V. B. Watwood, Jr. 4 Oct. 1963 14 p
(D2-22761; AD-447958)

Equations of motion are derived that are applicable to spinning space-station configurations consisting of two very stiff bodies connected by a relatively long, compliant, and

lightweight (less than 10% of the total mass) structure. The general approach used in deriving the equations is that of LaGrange, with the eight independent Euler angles as generalized coordinates. M.P.G.

N64-32643* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUMERICAL PROCEDURES FOR STABILITY STUDIES
Robert S. Ryan 19 Aug. 1964 51 p refs Supersedes MTP-AERO-63-42
(NASA-TM-X-53109; MTP-AERO-63-42) OTS: $3.00 fs; $0.50 mf

This report presents the numerical procedures used in performing stability analysis for large space vehicles with a more complex control system, and wherein a large number of modes of oscillation must be considered. The modes of oscillation included in the system are bending, translation, pitching, sloshing, and swivel engine. Equations describing the characteristics of the control sensors are included for rate gyros, accelerometers, and angle-of-attack meter. Two numerical methods for solving the system for its eigenvalues are presented—the characteristic equation and the matrix iteration approach. A plan for using the procedures in evaluating a vehicle for stability, filter design, and propellant damping is also developed. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-32486* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPULSION DEVELOPMENT PROBLEMS ASSOCIATED WITH LARGE LIQUID ROCKETS
A. A. Mc Cool and G. H. Mc Kay, Jr. 12 Aug. 1963 29 p
(NASA-TM-X-53075) OTS: $2.00 fs; $0.50 mf

Propulsion development problems of the Saturn I and Saturn V vehicles are reviewed. The problems discussed include the following: (1) cluster tankage problems; (2) propellant feed-system development; (3) propellant-tank location for S-IC stage; (4) propellant conditioning for engine start; and (5) base heating from engine-exhaust gases. D.S.G.

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-31385* Michigan U., Ann Arbor
GROUND BASED ACOUSTIC DETECTION OF HIGH ALTITUDE EXPLOSIONS
H. F. Allen *In* AFCRL Proj. Firefly, 1962–1963 May 1964 p 257–265 (See N64-31376 23-12)
(Contract NASr-54(02))

Eight successful firings of Nike-Cajun rockets carrying high-explosive charges were monitored from two sites, using three types of low-frequency sound transducers. These included two capacitor microphones, two hot-wire microphones, and a microbarograph. Author

N64-31523 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE "ELEKTRON" SPACE SYSTEM
In its Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 1–7 (See N64-31522 23-29)

Two scientific space stations, "Elektron-1" and "Elektron-2", launched in substantially different orbits by a single rocket are discussed. The two satellites study the internal and external radiation belts of the earth. The satellites also investigate the ultraviolet radiation of the sun, cosmic rays, magnetic fields, etc. A list of the scientific apparatus mounted on the satellites is presented. Data from measurements taken at all points of the orbit are read into storage devices carried on board. During communications sessions, transmission of the stored information is accompanied by direct telemetric transmission of the large number of parameters registered by the scientific instruments, and data are transmitted on the performance of all systems onboard the satellites. The angular attitude of the "Elektron" stations in space is determined by the solar-orientation sensors, whose indications are registered in the storage units. P.V.E.

N64-31524 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INTERPLANETARY FLIGHTS WITH CONSTANT OUTPUT ENGINES
V. V. Beletskiy and V. A. Yegorov *In its* Cosmic Res., Vol. 2, No. 3, 1964 28 Jul. 1964 p 8–55 refs (See N64-31522 23-29)

The problem of interplanetary flight of a jet-propelled vehicle with an ionic or plasma engine is investigated on the assumption that the jet-reaction power output is constant. The study is made basically by the transporting-trajectory method—a method of linearizing the equations with respect to a certain suitably selected reference trajectory. The method is convenient for the rapidity of its calculations and has high accuracy for a broad class of practically interesting trajectories. Flights with optimum control of the jet acceleration are studied, as well as flights with a constant jet-acceleration vector that changes direction once. Author

N64-31620 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK JANUARY 1964 FIRINGS Data Report
Edward C. Kinsloe, III May 1964 248 p
(IRIG-MWG-29-64; AD-446227)

Wind and temperature measurements taken by rocketsondes fired from various locations around the world are presented. The data presented include the following (if recorded): (1) rocket winds—time and altitude; (2) wind components; (3) thermodynamics—temperature, pressure, density

and speed of sound; and (4) composition—ozone concentration, electron density, and Lyman alpha radiation. Also included are radiosonde data obtained near (±6 hours) the time of firing. The radiosonde data include the following: pressure, altitude, wind components, relative humidity, and temperature. P.V.E.

N64-31621 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK FEBRUARY 1964 FIRINGS Data Report
Edward C. Kinsloe, III Jun. 1964 203 p
(IRIG-MWG-30-64; AD-446228)

The wind- and temperature-data measurements obtained with rocket probes of the upper atmosphere, during February 1964, are presented. Also included are radiosonde observations taken near (±6 hours) the time of firing. The data were obtained from rocketsonde observations taken from various points around the world. Data presented include these: (1) rocket winds—time and altitude, and wind components; (2) thermodynamics—temperature, pressure, density, and speed of sound; (3) composition—ozone concentration, electron density, and Lyman alpha radiation. The radiosonde data include the following: pressure, wind components, relative humidity, and temperature. P.V.E.

N64-31888 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK MARCH 1964 FIRINGS Data Report
Edward C. Kinsloe, III Jul. 1964 245 p
(IRIG-MWG-31-64; AD-448621)

Included are the meteorological-rocket sounding data contributed by the agencies of the Meteorological Rocket Network. R.L.K.

N64-32046 Air Force Systems Command, Eglin AFB, Fla. Research and Technology Div.
COMPARISON OF EXPERIMENTAL AND THEORETICAL DISPERSION FOR VERTICAL PROBE ROCKETS (WITH EMPHASIS ON WIND EFFECTS)
John C. Hooton Mar. 1964 19 p refs
(ATL-TDR-64-13; AD-447820)

This study was conducted in order to compare experimental dispersion results with theoretical computations for rockets where the wind dispersion contributes over 50% of the total dispersion. Areas are determined in which computational improvements can be made to give greater accuracy in predicting the impact of future vertical probe rocket launchings. Conclusions and recommendations are derived that are applicable to the subsequent improvement of theoretical computations. Author

N64-32108 Air Force Cambridge Research Labs., Bedford, Mass.
LONG LINE AZIMUTHS FROM OPTICAL OBSERVATIONS OF THE ANNA FLASHING SATELLITE Environmental Research Papers No. 21
Armando Mancini Jun. 1964 22 p refs
(AFCRL-64-446; AD-605538)

Geodetic azimuths of lines ranging from 300 km to 1400 km have been determined from simultaneous optical observations of the ANNA flashing satellite. The results of this test prove that the azimuth or the space direction between two stations can be achieved to an accuracy better than one second with only a limited amount of data. The reason for the high accuracy is attributed to two factors: (1) the metric accuracy of the PC-1000's stellar cameras, and (2) the "perfect" simultaneity in the observations provided by the ANNA strobe light. Author

N64-32185 White Sands Missile Range, N. Mex. Inter-range Instrumentation Group
METEOROLOGICAL ROCKET NETWORK FIRINGS, VOLUME IV. INTERNATIONAL ROCKET INTERVAL, SEPTEMBER 1960 FIRINGS Data Report
Jul. 1964 61 p
(IRIG-109-62; AD-448600)

Wind and temperature data from 20 Meteorological Rocket Network firings between September 16 and 23, 1960, are presented. A complete index, with launch sites and computer-data-sheet page numbers, is included. M.P.G.

N64-32201 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
INVESTIGATION OF AEROSPACE VEHICLE CREW STATION CRITERIA Final Report
J. A. Moran and P. R. Tiller Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., 31 Jul. 1964 450 p refs
(Contract AF 33(615)-1297)
(SID-64-997; FDL-TDR-64-86; AD-603784)

This report presents an analysis of the crew station design criteria for three types of space vehicles. As defined in this report they are as follows: (1) a vertical launch, horizontal landing, low orbital vehicle, (250 to 300 n.mi.) manned by a crew of three and designed for reconnaissance and surveillance; (2) a horizontal launched, horizontal landing, high-orbit (19 350 miles) vehicle, manned by a crew of three and capable of supporting five passengers over a 10-day period; (3) a nonrecoverable low orbital (250 to 300 n. mi.) space station capable of supporting a crew of 21 men for a minimum period of 30 days. Recommendations are made in the design of mission-oriented stations and life support stations. Author

N64-32344 Gt. Brit. Dept. of Scientific and Industrial Research Radio Research Station
WORLD DATA CENTER C: ROCKETS AND SATELLITES. CATALOGUE OF DATA RECEIVED BETWEEN 1 JAN.–30 JUN. 1964
1964 22 p

The rocketry data that were cataloged include flight information summaries and meteorological information. Satellite data include type (moonwatch, visual, radio direction, photographic), country of origin, and orbit. Radio propagation data include frequency and field strength. A.W.

N64-32366 Army Electronics Research and Development Activity, White Sands Missile Range, N.Mex.
METEOROLOGICAL ROCKET NETWORK NOVEMBER 1963 FIRINGS Data Report
Edward C. Kinsloe, III Feb. 1964 219 p
(IRIG-MWG-27-63; AD-447965)

Reported are wind and temperature measurements collected from all available network firings plus the radiosonde observations nearest the time of firing. R.L.K.

N64-32393 Radio Corp. of America, Princeton, N.J.
RANGE CALIBRATION SATELLITE Preliminary Design Report, Jun. 24–Oct. 31, 1963
Joseph F. Geary, Jr. Oct. 1963 259 p
(Contract AF 19(628)-3260)
(AEDR-2135; AD-442742)

The Range Calibration Satellite (RCS) is a 300-pound spacecraft that is to be used as a calibration tool for range instrumentation equipment. For the calibration mission, the spacecraft carries MISTRAM and GLOTRAC radars, a DPN-66 transponder, and an optical beacon. The flash from the optical beacon can be photographed against a stellar background. The satellite is to be launched into a nominally circular 400-n. mi. orbit by the Thor Delta launch vehicle. The orbit inclination of 40 degrees was selected to satisfy the requirements of the worldwide electronic tracking stations. Topics covered include summary of RCS design, system utilization, spacecraft configuration, attitude stabilization subsystem, thermal control, power-supply subsystem, command and control subsystem, beacon and telemetry subsystem, transponder antenna design, passive-tracking aid, calibration device integration in the spacecraft, system integration and test, and environmental test program. D.E.W.

N64-32398 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ROCKETS AND INTERPLANETARY FLIGHTS
B. V. Lyapunov 11 Jun. 1963 143 p refs Transl. into ENGLISH of the book "Rakety i Mezhplanetnyye Polety" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1962 p 1–122
(FTD-TT-63-210/1+2; AD-602559)

The evolution in the U.S.S.R. of the idea of interplanetary travel is traced from Kibal'chich and Tsiolkovskiy to the early twentieth-century experimenters, such as Kondratyuk. The principles of rocketry and interplanetary flight guidance are discussed in nontechnical terms. Progress and accomplishments of Soviet rocket and space research are noted in detail, and the first flights in the Explorer and Vanguard series are mentioned. Laboratory experiments, trial satellite launchings, life-support system development, guidance and control system development, and other work necessary to successful manned space flight are described. The orbital flights of Vostok I and Vostok II are narrated in detail, and hazards of space flight are enumerated. A review of non-Russian design work on earth-orbiting manned space stations is presented. Forecasts of future space accomplishments are given, and a chronology of Russian space achievements is presented. D.E.W.

N64-32402* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
A PARAMETRIC STUDY OF CONSTANT THRUST, ELECTRICALLY PROPELLED MARS AND VENUS ORBITING PROBES
Leonard G. Rossa Washington, NASA, Oct. 1964 30 p refs
(NASA-TN-D-2154) OTS: $0.75

A study has been made to determine the effect of mission travel time and the vehicle performance parameters on payload for the Mars and Venus orbiting probe missions. The vehicle is assumed representative of early electrically propelled spacecraft that operate at constant thrust and constant effective specific impulse. For both the Mars and Venus missions, propellant fraction is given for a wide range of effective jet power to initial weight ratio P_{jeff}/W_0, effective specific impulse I_{eff}, and total travel time T_t. Propellant fractions are comparable for Venus missions 25 days shorter than Mars missions, and the effect of initial orbit altitude on propellant fraction is insignificant. The effects of P_{jeff}/W_0, I_{eff}, and T_t on payload fraction w_L are illustrated. In addition, the effects of specific powerplant weight α and a structural factor on maximum payload fraction are given for the range of travel times. Author

N64-32425 Army Missile Command, Huntsville, Ala.
SUMMARY OF ASP METEOROLOGICAL ROCKET FIRINGS AT CAPE CANAVERAL, FLA.
Novella S. Billions 11 Mar. 1963 15 p ref
(RR-TN-63-1; AD-442724)

Density data obtained from ion densitometers instrumented in the ogive of the ASP rocket are shown in graphical and tabular form. These density measurements were obtained during the ascending flight of the ASP rocket. Author

N64-32457 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE STORMING OF SPACE CONTINUES. THE SECOND ANNIVERSARY OF THE FLIGHT OF COSMONAUT-2
Ye. Petrov 27 Mar. 1964 11 p Transl. into ENGLISH from Pravda Ukrainy (Kiev), 6 Aug. 1963 p 4
(FTD-TT-64-147/1+4; AD-449217)

Important conclusions as to man's performance under extended weightlessness are considered as one of the benefits of the first 24-hour space flight on Vostok II. Other valuable data secured are listed as the reliability of the life-support system for space flight, and the opportunity to study the problems of the prolonged effect on man of numerous space factors and conditions. A.W.

N64-32635* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH 2ND INTERPLANETARY EXPLORER SATELLITE News Release No. 64-242
29 Sep. 1964 25 p Available from the Scientific and Technical Information Division

According to NASA, the second in the Interplanetary Monitoring Platform (IMP) series, known as IMP B, is launched by a three-stage Delta; the orbit extends 126 500 miles into interplanetary space and 120 miles from the earth; and the orbital period is approximately 98 1/2 hours at an inclination of 33° to the equator. Background information IMP B is given in detail, and the scientific objectives are discussed. E.C.

N64-32654 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL ROCKET NETWORK FIRINGS. VOLUME III: SPRING 1960 FIRINGS Data Reports
Apr. 1964 162 p
(IRIG-109-62; AD-449618)

This is a meteorological data report from various earth-based ranges of the spring of 1960. Observed were chaff dispersion and fall rate of Loki I, Loki II, Arcas, and Arcas–Robin configuration. Wind and altitude data were obtained from radar plotting grids through a graphical conversion of the sensor displacement during a standard time, and wind profiles gained by computation of 1-minute time-interval values. Temperature data were observed by a modified 1680-Mc radiosonde transmitter, recorded with standard ground detection equipment, and published in raw form. G.G.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-31438 Tohoku U., Sendai (Japan) Inst. of High Speed Mechanics

INFLUENCE OF LARGE AMPLITUDES ON FLEXURAL VIBRATIONS OF ELASTIC PLATES

N. Yamaki *In its* Rept. of the Inst. of High Speed Mech., Vol. 15, 1963/1964 [1964] p 159–178 refs Presented at the 37th Gen. Meeting of the Japan Soc. of Mech. Engr., 1 Apr. 1960 (See N64-31429 23-11)
(Rept.-149)

Based on the von Karman plate equations generalized to a dynamic case, nonlinear bending vibrations of rectangular and circular plates are studied under various boundary conditions. The defection function is assumed in the form of a product of the appropriate spatial function and the unknown time function, which is related to the stress function through the compatibility condition. The equation of motion is satisfied approximately by a Galerkin procedure, which leads to an ordinary nonlinear differential equation for the determination of the time function. Numerical solutions are obtained for the cases of square and circular plates, and the effects of large amplitudes on both the free and forced vibrations are clarified. Solutions for the static case agree well with known results. Author

N64-31649 Army Tank-Automotive Command, Center Line, Mich. Land Locomotion Lab.

ADDITIONAL RESULTS ON THE STATISTICAL ANALYSIS OF A LINEAR VEHICLE USING MEASURED GROUND POWER SPECTRAL DENSITY

John L. Bogdanoff and Frank Kozin Nov. 1963 29 p refs
(Rept.-8392; AD-438406)

An extension is presented of previous results of the authors, relating the parameters of an idealized two-dimensional linear vehicle to stable ground roughness as described by power spectral densities. Optimal vehicle parameters are obtained relative to a ride-roughness criterion for ground contours described by power spectral densities estimated from real ground-survey data. It is found that the ride is not sensitive to changes in the wheel-base-length parameter when this is over 14 feet. However, the ride is found to be sensitive to damping and speed in this wheel-based-length range. Author

N64-31650 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.

THE LONGITUDINAL MOTION OF A VIBRATING ROD WITH ATTACHED MASS IN A RESISTING MEDIUM

John D. Somes 24 Jul. 1964 76 p refs
(NWL-1931; AD-447104)

The solution for the longitudinal motion of an elastic rod with a mass attached at one end is extended to the case where the motion is subject to linear frictional damping. The friction acting on the rod and on the mass may be specified separately. Laplace transform methods are employed in the solution, and extensions are derived both for the residue (infinite series) solution and for the solution in the form of superposed waves (closed solution). Some discussion is devoted to a computer program developed to handle the general residue solution, and a set of numerical results is given. Author

N64-31651 Stanford Research Inst., Menlo Park, Calif. Poulter Research Lab.

INVESTIGATION OF RESPONSE OF SIMPLIFIED ICBM-TYPE STRUCTURES TO IMPULSIVE LOADING, VOLUME II Final Report

G. R. Abrahamson, A. L. Florence, and H. E. Lindberg Kirtland AFB, N. Mex., AF Spec. Weapons Center, Jul. 1964 191 p refs
(Contract AF 29(601)-4329)
(AFWL-TDR-64-22, Vol. II; AD-444363)

Previous work on the response of simplified ICBM-type structures to impulsive loads is extended for beams, plates, rods, cylindrical shells, and spherical shells. Rigid-plastic theory is used to study the response of beams and plates, and the results are compared with experiments. Elastic analysis is used to investigate the effects of simulating an instantaneous load with a traveling load. The theory of elastically precipitated buckling, which may subsequently develop into plastic deformations, is extended for thin strips and thin cylinders. Theoretical predictions are compared with experimental results. Flow buckling theory is extended to rods under axial impact and to spherical shells under "uniform" radial impulse; experimental results are presented. Author

N64-31835 Martin Co., Baltimore, Md.

INTEGRATED BUFFET LOADS ON THE FORWARD PORTION OF A .085 SCALE GEMINI LAUNCH VEHICLE MODEL VOLUME II: 9′ × 7′ SWT AND 11′ TWT

C. G. Stouffer, J. Sudey, and W. S. Gorrell Jun. 1964 141 p refs
(Contract AF 04(695)-394)
(LV-279-II; AD-448615)

Presented are the results of an experimental investigation conducted on a 0.085-scale model of the Gemini launch vehicle to determine integrated vehicle buffet bending moments over a frequency range encompassing the first three fundamental vehicle modes. The Mach number at which peak buffet bending moments occurred was M = 1.0, which is in contradiction to the results of the earlier test. Conflictions of data results during the investigation in the 11-ft transonic wind tunnel are discussed. The results are presented in the form of faired power-spectral densities over the frequency range from 20 to 200 cps and as summary plots of the nondimensionalized buffet excitation moment power-spectral density vs Mach number for the first GLV model excitations. Author

N64-31836 Martin Co., Baltimore, Md. Space Systems Div.

GEMINI LAUNCH VEHICLE BUFFET LOADS

W. R. Case Jun. 1964 70 p refs
(Contract AF 04(695)-394)
(LV-280; AD-448612)

Transonic buffet loads on the full-scale Gemini launch vehicle are predicted on the basis of data obtained from 8.5% model tests conducted in 14ft, 11ft, and 9 × 7ft wind tunnels. The results of the analyses are presented as 3 σ values of the overall vehicle loads in terms of bending moments and shear through the Mach number range 0.7 to 2.5. Also presented is an analysis of the local shell reponse to transonic buffet pressure excitation in the Stage II forward oxidizer skirt area through the Mach number range 0.6 to 1.14. Author

N64-31898 Wisconsin U., Madison Mathematics Research Center
ON THE PRINCIPLE OF SAINT-VENANT
A. Dou May 1964 66 p refs
(Contract DA-11-022-ORD-2059)
(MRC-472; AD-603282)

The principle asserts that the stress tensor in points of a beam or cylinder sufficiently far removed from its bases does not depend practically on the distribution of the applied forces in the bases, but depends only on their resultant force and resultant moments. The principle is considered in its original form for bounded bodies and it is shown by means of a counter-example that in order to insure its validity some restriction must be imposed on the shape of the body. A cylinder is considered, and through construction of a virtual stress tensor and application of the theorem of minimum strain energy an upper estimate of the total potential elastic energy is obtained, which is independent of the length of the cylinder. The infinite cylinder is considered and it is proven that there cannot be any other stress-bounded solution than those of Saint Venant's type. Author

N64-31921 Brown U., Providence, R.I. Engineering Materials Research Lab.
A DISPLACEMENT BOUND PRINCIPLE FOR ELASTIC CONTINUA SUBJECTED TO CERTAIN CLASSES OF DYNAMIC LOADING
J. B. Martin Aug. 1963 21 p refs
(Contract Nonr 4017(00)(X))
(BU/DTMB/2; AD-421004)

The paper presents a general inequality relating statically admissible stress fields and kinematically admissible strain and displacement fields in an elastic continuum. The relation between the inequality and some established energy theorems is discussed, and the inequality is used to compute displacement bounds for elastic continua subjected to certain types of impulsive loading. Author

N64-31922 Brown U., Providence, R.I. Div. of Engineering
A DISPLACEMENT BOUND PRINCIPLE FOR INELASTIC CONTINUA SUBJECTED TO CERTAIN CLASSES OF DYNAMIC LOADING
J. B. Martin Sep. 1963 22 p refs
(Contract Nonr-4017(00)(X))
(BU/DTMB/3; AD-421006)

The paper presents an inequality relating statically admissible stress fields and kinematically admissible displacement fields for continua composed of inelastic materials that obey a postulated criterion of stability. The inequality is used to compute displacement bounds for inelastic continua subjected to certain classes of dynamic loading. Author

N64-31930 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON A NEW METHOD FOR THE EXPERIMENTAL STUDY OF ELASTIC STRESSES
Cu. Fabry 3 Sep. 1964 6 p ref Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 190, 1930 p 457-460
(RSIC-262; AD-606140)

The elastic stresses on a uniformly thick glass sheet, lightly silvered on both faces and illuminated by monochromatic green radiation of mercury, were observed by transmission. The fine, bright lightfringes produced by the monochromatic light were displaced and split in two when the foil underwent stress, and assumed two optical thicknesses. These two fringe displacements in comparison to the original values constituted the variations in thicknesses. The lightfringes were observed either by a parallel light normal to the foil, as in "lines of equal optical thickness," or by using less than 1 sqmm of foil for observation, as in the "rings of infinity" method. G.G.

N64-31983 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
THE FLUTTER OF TWO-BAY FLAT PANELS OF INFINITE SPAN AT SUPERSONIC MACH NUMBERS
M. H. Lock and Edith F. Farkas 25 Aug. 1964 75 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-164; TDR-269(4230-10)-9; AD-606405)

The flutter of two-bay clamped-edge and simply supported panels at supersonic Mach numbers is studied to determine the influence of structural and aerodynamic coupling. The effect of structural coupling between the panel bays is unimportant both for the single-degree-of-freedom flutter modes that are critical at the lower supersonic Mach numbers and for the critical coupled flutter modes that develop at higher supersonic Mach numbers. The effect of aerodynamic coupling is found to be of importance for the single-degree-of-freedom flutter modes only. Furthermore, the severity of this effect is highly dependent upon the panel boundary conditions. Author

N64-32065 Aberdeen Proving Ground, Md. Ballistic Research Labs.
VISCO-PLASTIC FLOW AT THE IMPACT OF A CYLINDER ON A PLATE
F. A. Bahshian Mar. 1964 15 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. XII, 1948
(AD-602179) OTS: $1.00

The solution to the problem of viscoplastic flow at the impact of a cylinder on a plate is based on the theory developed by Ilyushin. The result of computations described in the paper permits a judgment as follows. Unlike a viscous fluid, the viscoplastic condition encompasses a finite region at the initial moment. The effect of the influence of viscosity of the metal is considerable at large velocities of deformation. A.W.

N64-32123 Catholic U. of America, Washington, D.C. Stress Analysis Lab.
THERMAL STRESSES AT THE CLOSED END OF THE EM-1 VESSEL, PHASE II Final Report
A. J. Durelli and V. J. Parks Apr. 1963 54 p Prepared for Allegany Ballistics Lab., Hercules Powder Co.
(Contract NOrd-16640)
(AD-447818)

This report deals with three-dimensional photoelasticity tests conducted on models of the EM-1 vessel. Epoxy resins were cast inside glass-fiber-reinforced cases, and shrinkage stresses were produced by the curing contraction of the resin and the differential thermal contraction between case and resin. The results of the tests have substantiated the two-dimensional simulations used in another part of the program. Author

N64-32143 IIT Research Inst., Chicago, Ill. Technology Center
THREE-DIMENSIONAL PHOTOELASTICITY STUDY OF THICK-WALLED CYLINDRICAL SHELLS Technical Documentary Report, 13 May 1963-30 Apr. 1964

John Vieira and W. F. Riley Kirtland AFB, N. Mex., AF Weapons Lab., Aug. 1964 48 p
(Contracts DASA-WEB-13.148; AF 29(601)-5362)
(AFWL-TDR-64-65; AD-606571)

A study was conducted to determine stress distributions in several types of thick-walled cylindrical shells. The stresses were determined by using both the embedded-polariscope and stress-freezing methods for three-dimensional photoelasticity. The study indicates that an approximate analytical solution for stresses in thick-walled cylinders with hemispherical heads is sufficiently accurate for structural design applications. Simple curved beam theory is also shown to give reasonable stress values for certain structures that take the form of a thick-walled half cylinder. The study indicates that embedded polaroid elements perform satisfactorily under complex states of stress; therefore, the embedded-polariscope method represents a completely feasible approach for transient three-dimensional stress determinations. Author

N64-32155 Naval Research Establishment, Dartmouth (Canada)
AN EXPERIMENTAL STUDY OF THE VIBRATIONS OF SOLID ISOTROPIC ELASTIC CYLINDERS
G. W. Mc Mahon Mar. 1963 14 p refs
(NRE 63/4; AD-421477)

An experimental study has been carried out to determine the natural frequencies of vibration of solid isotropic elastic cylinders with free boundaries. Solid aluminum and steel cylinders having height-to-radius ratios (h/a) between 0.2 and 3.3 have been studied. Twenty of the graver modes were excited by means of a barium titanate driver loosely coupled to the metal cylinders. Six modes of circumferential order zero, seven modes of order unity, four modes of order two, and three modes of order three were studied in the range of dimensionless frequency parameter $\omega a/c$ from zero to 2.6. Sand patterns and a small vibration probe were used to determine the form of the vibrations. Where possible, the frequencies are compared with the results of existing theory. Author

N64-32157 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
OPTIMUM CONSTRUCTION OF REINFORCED PLASTIC CYLINDERS SUBJECTED TO HIGH EXTERNAL PRESSURE Quarterly Progress Report No. 2, 6 Jun.–6 Sep. 1963
H. R. Jacobson 6 Sep. 1963 38 p refs
(Contract NObs-88425)
(SM-44594; AD-420201)

The purpose of this program is to develop and prove out a theoretical method for accurately predicting the critical buckling strength of externally pressurized cylinders made from orthotropic materials and to find the optimum construction of filament reinforced plastic (FRP) cylinders under such loading. Results of buckling and jig discontinuity analyses of test-cylinder configurations are presented. Studies were performed on effects of shear rigidity and thickness on the bending and buckling of thick FRP rings to gain an insight into possible effects on buckling of thick FRP cylinders. Fabrication of test cylinders was started, and a description of fabrication methods is included. Author

N64-32189 Bureau of Mines, Pittsburgh, Pa. Explosives Research Center
HYPERVELOCITY IMPACT PHENOMENA Quarterly Report, 1 Sep.–30 Nov. 1963
Richard W. Watson, Karl R. Becker, and Frank C. Gibson 5 Feb. 1964 30 p refs
(AD-293457)

The plate–pellet technique is being used in an investigation of shock-wave attenuation and characteristic target damage using explosive-generated shock waves. The three target materials (aluminum, magnesium, and a steel alloy) were used in various thicknesses to provide target-damage effects, ranging from perforation through back surface spalling to only slight bulging. The results are tabulated in terms of wafer velocity as a function of target thickness. The development and performance of two new hypervelocity projectors are also discussed. One is a one-half linear-scale inhibited jet projector and the other is a double linear-scale air-cavity-type projector. Although the masses and velocities of the projectiles produced by each of the projectors are considerably different, the kinetic energies are nearly the same. M.P.G.

N64-32209 Columbia U., New York, N.Y.
RANDOM FATIGUE FAILURE OF A MULTIPLE LOAD PATH REDUNDANT STRUCTURE Technical Documentary Report, Sep. 1, 1962–Jan. 31, 1964
A. S. Heller, R. A. Heller, and A. M. Freudenthal Wright-Patterson AFB, Ohio, AF Mater. Lab., 1964 33 p refs
(Contract AF 33(616)-7042)
(ML-TDR-64-160; AD-604125)

The object of the investigation is the determination of the fatigue life of a multiple load path redundant structure consisting of geometrically similar members having statistically distributed initial strengths and subjected to randomized fatigue loads derived from an exponentially distributed gust spectrum. A modified linear damage rule and failure condition based on ultimate carrying capacity is being used. The method allows computation of a median fail-safe fatigue life of the structure, as well as the consecutive failure of individual members. Three aircraft structural materials—7075-T6 and 2024-T4 aluminum, SAE 4340 steel—have been investigated. Fatigue lives shorter than those calculated using the linear damage rule are obtained. Author

N64-32211 Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
HYDROELASTIC STUDY OF ELASTIC BEAMS WITH A FOIL-SHAPED APPENDAGE
Charles J. Henry and M. Raihan Ali Jul. 1964 123 p refs
(Contract NObs-84461)
(R-1022; AD-603017)

Equations of motion were derived for the free vibrations of an elastic beam representing a ship's hull with a foil-shaped appendage, under the action of unsteady hydrodynamic loads. Hydrodynamic effects on the foil have been taken into account by two-dimensional unsteady flow theory applied in a stripwise fashion, whereas the hydrodynamic effects on the hull have been neglected, although corrections for added mass can be included. Computer programs were developed by which the decay rate and frequency of response in up to six degrees of freedom can be calculated for the hull-appendage system. Thereby, the effect of forward speed is taken into account through the hydrodynamic damping force acting on the oscillating foil-shaped appendage. A cursory study of a two-degree-of-freedom system with hull bending and foil torsion showed that flutter of the hull-appendage system is possible even when hull damping is included. Author

N64-32215 Picatinny Arsenal, Dover, N.J. Engineering Sciences Lab.
BLAST EFFECTS TESTS ON SIMPLE INSTRUMENTED SHELLS

Lawrence Rosendorf Feb. 1964 52 p refs
(PA-TM-1420; AD-602232) OTS: $3.00

This report presents the results of a series of high-explosive blast tests. Pressure–time histories and strain–time histories are presented for two free-air blast overpressures on combination conical and cylindrical thin-walled shells. Author

N64-32277 Brown U., Providence, R.I. Engineering Materials Research Lab.
BOUND THEOREMS FOR RIGID-PLASTIC CONTINUA SUBJECTED TO CERTAIN CLASSES OF DYNAMIC LOADING
J. B. Martin Jul. 1963 21 p refs
(Contract Nonr-4017(00)(X))
(BU/DTMB/1; AD-421005)

Continua composed of a rigid-plastic strain rate insensitive material subjected to some initial velocity distribution are considered. Two theorems, bounding the response time and the deflection at any point, respectively, are presented. A physical interpretation of the bounds is given, and the accuracy and significance of the bounds are discussed. Author

N64-32294 David Taylor Model Basin, Washington, D.C.
SHEAR AND ROTARY INERTIA EFFECTS ON BEAM VIBRATIONS
Ralph C. Leibowitz and Earle H. Kennard Jul. 1964 19 p refs
(DTMB-1822; AD-605290)

The effects of shear rigidity and rotary inertia on a vibrating uniform free-free beam are analyzed in order to throw light on the vibration of a ship hull represented by a moderately nonuniform beam. A simple first-order approximation is devised for use in calculating several modes of vibration of a slender beam (small height-to-length-ratio) that includes these important effects. Author

N64-32305 Joint Publications Research Service, Washington, D.C.
SOME UNSOLVED PROBLEMS IN VIBRATION THEORY
Ye. Ts. Andreyeva-Galanina 15 Oct. 1964 8 p Transl. into ENGLISH from Gigiena Truda i Prof. Zabolevaniya (Moscow), v. 8, no. 8, Aug. 1964 p 3–7
(JPRS-26922; TT-64-51178) OTS: $1.00

Some of the problems considered by the author are the effect on workers of vibrations caused by mechanized and electrical tools; the etiology of vibration illness among workers in concrete; the symptoms and syndromes caused by percussive hammers; the nature of shock recoil; the significance of sound; and the simultaneous action of sound and vibration upon the human nervous system. A.W.

N64-32361 Massachusetts Inst. of Tech., Cambridge
RANDOM VIBRATION IN AEROSTRUCTURES Final Report
Stephan H. Crandall 15 Jan. 1964 4 p refs
(Grant AF-AFOSR-282-63)
(AD-447952)

Studies aimed at achieving a deeper fundamental understanding of the transmission of random vibration in aerostructures and the relation of random vibration to mechanical failure are reported in three areas: (1) random vibrations in nonlinear systems; (2) fatigue failure under random vibration; and (3) failure due to first passage of a random vibration response up to a critical level. M.P.G.

N64-32429* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
ANALYSIS OF PLASTIC THERMAL STRESSES AND STRAINS IN FINITE THIN PLATE OF STRAIN-HARDENING MATERIAL
Ernest Roberts, Jr. and Alexander Mendelson Washington, NASA, Oct. 1964 26 p refs
(NASA-TN-D-2206) OTS: $0.75

A practical method for obtaining the plastic deformations in a biaxial stress field is presented. The method is numerical, utilizing a system of successive approximations. There are no limitations regarding boundaries, loading history, stress–strain curves, or temperature dependence of material properties. The incremental theory of plasticity is used. Two examples are presented for strain-hardening materials: a thermally loaded long rectangular plate, and a thermally loaded square plate. Where possible, comparisons are made with existing solutions. The validity of certain approximations to the solution is also investigated. Author

N64-32431* IIT Research Inst., Chicago, Ill.
PRESTRESSED MONOLITHIC AND SEGMENTED BRITTLE STRUCTURES
R. L. Barnett, Paul Hermann, and James Costello Washington, NASA, Oct. 1964 95 p refs
(Contract NASr-65(04))
(NASA-CR-113) OTS: $2.25

The premature longitudinal cracking of segmented columns has been identified as one of the most serious problems in the design of prestressed segmented ceramic members. Circumstantial evidence is presented to support the contention that large transverse tensile stresses are developed because of the nonflatness of segment interfaces. Two first-order models are developed for predicting the nonlinear response of prestressed segmented beams. The validity of the models is demonstrated experimentally, and many of the characteristics of segmented beams are explored. The strength of prestressed monolithic brittle beams is formulated in terms of reliability, and a specific example is treated in which the prestress leads to a 25-fold increase in strength when compared to a conventional beam of equal weight and reliability. Author

N64-32493 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
LABORATORY FOR STATICS AND PHOTOELASTICITY
A. de Marneffe 10 Aug. 1964 9 p ref Transl. into ENGLISH from Rev. Univ. Mines (Liege), v. 4, no. 1, 1948 p 64–66
(RSIC-241; AD-606888)

Equipment is discussed that is used to demonstrate new methods and procedures for use in teaching and in scientific research, as well as in the practical field of mechanical structures and civil engineering. Optical equipment for use in studying fixed or moving structural elements, structures in civil engineering, and in the exploitation of mines is included. Also discussed is influentiometry equipment. P.V.E.

N64-32497 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE DOUBLE REFRACTION TEMPORARILY PRODUCED IN ISOTROPIC BODIES, AND ON THE RELATIONSHIP BETWEEN MECHANICAL - AND PHOTOELASTICITY
M. G. Wertheim 18 Sep. 1964 51 p refs Transl. into ENGLISH from Ann. Chim. Phys. (Paris), Ser. 3, v. 40, 1854 p 156–221
(RSIC-270; AD-606778)

Double refraction produced artificially either by traction or compression is, for the same substance, proportional to the linear changes produced by this mechanical force along the principal axes and to the volume changes of the body. Temporary elongations and contractions caused by a given weight are neither rigorously equal to each other nor exactly proportional to these weights so long as they are relatively small. Optical axes coincide with mechanical axes for all truly isotropic substances. A.W.

N64-32584 Oceanics, Inc., Plainview, N.Y.
AN EXPERIMENTAL STUDY OF HYDROELASTIC INSTABILITIES OF FINITE SPAN HYDROFOILS UNDER CAVITATING CONDITIONS
Paul Kaplan and August F. Lehman Feb. 1964 62 p refs
(Contract NObs-88361)
(Rept.-64-12; AD-603265)

This report presents the results of water-tunnel tests that were carried out in order to determine the conditions for the occurrence of hydroelastic instabilities (flutter and/or divergence) of cavitated hydrofoils. Two different foil materials were used, with almost all of the basic parameters of significance being approximately equal, except for the density ratio. The tests were carried out for a range of cavity lengths from one-half the chord up to twice the chord, thereby covering conditions from partial cavitation to supercavitation. No flutter or divergence was experienced in these tests for the particular parameter conditions considered, but continuous (and often severe) oscillations were experienced in all tests when the cavity length was approximately equal to 0.75 times the chord. The validity of theoretical techniques in predicting the occurrence of the various types of hydroelastic instability (including steady-state oscillations) is discussed. Author

N64-32590 Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands)
DEFENSE WEAPONS TECHNIQUES, VIII (1963) [BEWAPENINGS-TECHNIEK VIII (1963)] Title Index
1963 92 p
(TDCK-15963)

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads.

N64-31552* General Electric Co., Philadelphia, Pa. Space Sciences Lab.
ACTIVE SHIELDING CONCEPTS FOR THE IONIZING RADIATION IN SPACE Final Report, 1 Sep. 1962–31 Aug. 1963
R. C. Good, S. P. Shen, and N. F. Dow 31 Jan. 1964 94 p refs
(Contract NASw-502)
(NASA-CR-58950) OTS: $3.00 fs; $0.50 mf

An effort was made to find the optimum weight for a spacecraft active shield, using electromagnetic fields. Protons in the range of 100 to 1000 MeV were chosen as the most dangerous ionizing radiation in space that could be shielded. Particles in space are isotropic, and shielding must provide for this. Topics covered are these: (1) theoretical calculations of magnetic fields and their effects on the trajectory of incident particles; (2) determination of coil-design factors (size, position, material, and support) for various shapes of spacecraft; (3) calculations of the weights for these configurations and selection of the optimum values considering the weight, supporting structure, and type of superconducting material; and (4) calculation of cascading effects of protons in iron, lucite, and chondrites. An electromagnetic-field system, using a toroidal-shaped spacecraft with a confined magnetic field was shown to be the lightest among those considered. In general, the active shield weight was only 20% that of the passive shield for high-energy protons and for large spacecraft. The shield with a confined field weighed 30% of that for a shield using an unconfined field. If hatches were included, the use of spherical modules led to spacecraft lighter than spheres, cylinders, or tori. For spacecraft in the shape of a torus, a passively shielded hatch is not required because there are no junctions between oppositely directed magnetic fields. R.L.K.

N64-31595 IIT Research Inst., Chicago, Ill.
APPROXIMATE BURSTING STRENGTH OF THIN-WALLED CYLINDERS WITH HEMISPHERICAL CAPS Summary Report, Jan. 1961–Apr. 1962
C. J. Costantino and M. A. Salmon [1962] 71 p refs
(Contract AT(11-1)-528)
(IITRI-528-20) OTS: $1.50

An approximate solution is presented for the bursting strength of thin-walled cylinders with hemispherically capped ends. Deformation theory of plasticity is used, together with the Mises yield criterion. Solutions are presented for hardening materials obeying both the Ludwik power hardening law and a linear strain hardening law. Comparisons of the results are made with the results for cylinders with rigid ends to determine the influence of end restraint on burst pressure. Numerical results are presented for cylinder lengths from zero (sphere) to infinity, and for a range of hardening coefficients. Author

N64-31704 David Taylor Model Basin, Washington, D.C. Structural Mechanics Lab.
PLASTIC GENERAL-INSTABILITY PRESSURE OF RING-STIFFENED CYLINDRICAL SHELLS
M. E. Lunchick Sep. 1963 34 p refs
(DTMB-1587; AD-421880)

A cylindrical shell stiffened by uniformly spaced transverse rings and subjected to external hydrostatic pressure is analyzed for collapse by plastic general instability. In this analysis, strain hardening of the material is taken into account. The plastic general-instability equation reduces to the elastic equation of Bryant when the secant and tangent moduli are set equal to Young's modulus. Author

N64-31712 Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
PRELIMINARY EVALUATION OF A LARGE-BULB SHIP FOR HIGH-SPEED OPERATION IN SMOOTH WATER AND IN ROUGH SEAS
Paul R. Van Mater, Jr. May 1964 42 p refs
(Contract Nonr-263(10))
(R-834; AD-441927)

This report describes an experimental investigation of the behavior in calm water and in waves of a model equipped with extremely large bow and stern bulbs. Results of the calm-water

resistance tests are presented for the model without bulbs, and for the model with the bulbs in three different configurations. Results are also presented for tests of one model configuration both in regular and irregular waves. On the basis of the test results, the performance of the large-bulb ship is evaluated in cimparison with other hull types. Practical advantages and disadvantages of the design concept for naval application are discussed. Author

N64-32204 IIT Research Inst., Chicago, Ill.
RESPONSE OF FOAM-ISOLATED TUNNEL LININGS TO TRANSIENT LOADINGS Final Report, 5 May 1963–15 Jan. 1964
E. M. Naureckas and W. F. Riley Kirtland AFB, N. Mex., AF Weapons Lab., Jun. 1964 47 p refs
(Contract AF 29(601)-6022)
(WL-TDR-64-28; AD-603539)

This research program was conducted to determine the behavior of a foam-isolated tunnel liner in an elastic material during passage of a plane stress wave. The specific objectives of the program included a determination of time-dependent stress fields in the elastic material, time-dependent magnitudes and location of crushing in the isolation material, and time-dependent stresses and motions of the tunnel liner. The results of the program indicate that the stresses in the liner are significantly reduced by the crushing of the foam. The rigid body motions of the liner, however, are not significantly influenced the presence of the foam. Author

N64-32434* Northrop Corp., Hawthorne, Calif. Northrop Space Labs.
SELF-SEALING STRUCTURES FOR CONTROL OF THE METEOROID HAZARD TO SPACE VEHICLES
Philip J. D'Anna, Roger M. Heitz, and James J. Piechocki Washington, NASA, Oct. 1964 122 p refs
(Contract NASr-102)
(NASA-CR-120) OTS: $2.75

Major effort is reported on ballistic testing and concept evaluation at impact velocities from 10000 to 26000 fps, and on investigation of techniques for control of shock-wave damage and material removal during high-velocity puncturing. Techniques investigated included using composite nonmetallic face sheets; isolating the chemical compartments of the chemically activated configurations from the panel face sheets, or interposing a highly compressible material between the chemical compartment wall and the face sheets; incorporating a volume-increasing mechanism, such as a foaming reaction in those configurations sensitive to material removal; and combining the best features of two or more concepts to give greater effective sealing action. D.E.W.

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